

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT

DISTRICT WIDE ENERGY SAVINGS PLAN

Revised February 15, 2019

Honeywell

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MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT

DISTRICT WIDE ENERGY SAVINGS PLAN

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SECTION A EXECUTIVE SUMMARY

Honeywell is pleased to submit this Energy Savings Plan for the Morris County Vocational School District. During the development of the Energy Savings Plan, Honeywell has completed a thorough investment grade energy audit of the Morris County Vocational School District's buildings and grounds. Based on the audit findings and Honeywell's extensive experience in working with municipalities, we can confidently state that we can deliver a financially viable, comprehensive solution to address Morris County Vocational School District's facility concerns. Our Energy Savings Plan includes projects that achieve energy and operational efficiencies, create a more comfortable and productive working environment and are actionable via the New Jersey Energy Savings Improvement Program (NJ ESIP) in accordance with NJ PL2012, c.55.

The Energy Savings Plan is the core of the NJ ESIP process. It describes the energy conservation measures that are planned and the cost calculations that support how the plan will pay for itself through the resulting energy savings. Under the law, the Energy Savings Plan must address the following elements:

- The results of the energy audit;
- A description of the energy conservation measures (ECMs) that will comprise the program;
- An estimate of greenhouse gas reductions resulting from those energy savings;
- Identification of all design and compliance issues and identification of who will provide these services;
- An assessment of risks involved in the successful implementation of the plan;
- Identify the eligibility for, and costs and revenues associated with, the PJM Independent System Operator for demand response and curtailable service activities;
- Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings;
- Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; and
- If developed by an ESCO, a description of, and cost estimates of a proposed energy savings guarantee.

The purpose of this document is to provide all the information required for the Morris County Vocational School District to determine the best path forward in the implementation of a District-Wide NJ ESIP Project. It is important to note that the Energy Savings Plan provides a comprehensive evaluation of ALL potential ECMs within the Morris County Vocational School District. This is not meant to infer that all the ECMs identified can be implemented. However, if the ECM is part of this plan, it may be implemented later as additional funding becomes available or technology changes to provide for an improved financial return.

Our Energy Savings Plan is structured to clearly demonstrate compliance with the NJ ESIP law, while also presenting the information in an organized manner which allows for informed decisions to be made. The information is divided into the following sections:

A. Executive Summary (This Section)

B. Preliminary Utility Analysis – The Preliminary Utility Analysis (PUA) defines the utility baseline for the Morris County Vocational School District buildings included in the Energy Savings Plan. It provides an overview of the current usage and a cost per square foot by building of utility expenses. The report also compares the Morris County Vocational School District's utility consumption to that of other districts in the same region on a per square foot basis.

C. Energy Conservation Measures – This section includes a detailed description of the ECMs we have selected and identified for your School District. It is specific to your facilities in scope, savings methodology and environmental impact. It is intended to provide a basis of design for each measure in narrative form. It is not intended to be a detailed specification for construction. ALL potential ECMs for the Morris County Vocational School District are identified for the purposes of potential inclusion in the program. Final selected ECMs are to be determined by the Morris County Vocational School District in conjunction with Honeywell during the project development phase of the NJ ESIP process.

D. Technical and Financial Summary – This section includes an accounting of all technical and financial outcomes associated with the ECMs as presented on the New Jersey Board of Public Utilities Forms II through IV. Information detailed on the forms includes projected implementation hard costs, projected energy savings, projected operational savings and projected environmental impact. Form VI: Annual Cash Flow Analysis provides a "rolled-up" view of the overall project financials, inclusive of financing costs, on an annual basis as well as over the entire 15 or 20-year term of the agreement.

Based on our preliminary discussions with the Morris County Vocational School District, the following sample self-funding project has been provided for review and consideration:

	Recommended ESIP Project
Value of Project	$902,027
Term of Repayment	15 Years
Projected Savings Over Term	$1,219,348
Projected NJ Rebates & Incentives	$97,754
Projected Interest Rate	3.5%

E. Measurement & Verification and Maintenance Plan – This section identifies the intended methods of verification and measurement for calculating energy savings. These methods are compliant with the International Measurement and Verification Protocols (IMVP), as well as other protocols previously approved by the Board of Public Utilities (BPU) in New Jersey. This section also includes the recommended maintenance requirements for each type of equipment. Consistent maintenance is essential to achieving the energy savings projected in this plan.

F. Design Approach – This section includes a summary of Honeywell's best practices for the successful implementation of a NJ ESIP project. It includes a project specific Safety Management Plan and provides an overview of our project management procedure, construction management and a sample schedule for the overall completion of the project. Within the schedule, we clearly define the tasks directed towards compliance with architectural, engineering and bidding procedures in accordance with New Jersey Public Contracts Law.

G. Independent Energy Audit – This section includes, for reference, the independent energy audits as previously received by the Morris County Vocational School District through the Local Government Energy Audit (LGEA) program. The audits, provided by CHA have been included on a USB drive as Appendix 1. A comparison can be made between the ECMs outlined in this Independent Energy Audit and the additional ECMs described in the overall Energy Savings Plan.

H. Energy Calculations and Greenhouse Gas Reduction Summary – This section titled Appendix 2: ECM Calculations includes all the energy calculations required to ensure compliance with the law and to confirm the energy savings can, and will, be achieved. These calculations are subject to an independent 3rd party engineering firm review for verification.

A summary of all savings based on the Recommended ESIP Project includes a reduction in 320,313 kWh (kilowatt hours of electricity), 19,710 Th (Therms of Natural Gas) and 270 Metric Tons of Greenhouse Gas (GHG) emissions. It is the equivalent of removing 57 cars from the road for an entire year and is the same as planting 256 acres of forest.

I. Equipment Cut-sheets – This section titled Appendix 3: Equipment Cut-sheets includes specification data for the equipment which shall be utilized as the basis of design for plans and specifications during the subsequent project development and NJ public bid phase.

J. Safety Management Plan – This section titled Appendix 4: Safety Management Plan establishes a plan for the implementation of Honeywell's Safe Operations Management (SOM) program. The document includes procedures and requirements specific to Morris County Vocational School District necessary to support a safe workplace for all stake holders. The Safety Management Plan is a living document, which will be updated and modified to maintain its relevance throughout the project as site conditions and circumstances change.

In accordance with the NJ ESIP process, the next step in the project development phase is for Honeywell to provide our recommendations and for Morris County Vocational School District to select the desired content of the project based upon the Morris County Vocational School District's unique goals and objectives. The selections will consider the projected costs, projected energy and operational savings, available financing options at the time of the agreement, interest rates, length of term and Morris County Vocational School District's priorities, which will all play a part in the final selection and cash flow of ECMs. The definitive requirement under NJ PL2012, c.55 is that the project is self-funding within the 15 or 20-year term as outlined in the legislation.

Overall, it is evident that Morris County Vocational School District is well positioned to implement a program that will upgrade your facilities, while funding itself within the requirements of the law and with zero impact on your taxpayer base. We welcome this opportunity to partner with Morris County Vocational School District to improve the comfort and efficiency of your facilities through the successful implementation of this Energy Savings Plan.

Sincerely,



Caroline Jackson
Energy Account Executive
Honeywell Building Solutions

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SECTION B PRELIMINARY UTILITY ANALYSIS

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Honeywell

Preliminary Utility Analysis

Morris County Vocational School District
Denville, NJ



Helping customers manage energy resources to improve financial performance

Executive Summary

Honeywell would like to thank you for the opportunity of providing you with this Preliminary Utility Analysis. A one year detailed billing analysis was completed for all utility data provided by your staff. The facility's electric and gas consumption were compared to a benchmark of typical facilities of similar use and location.

Through our Energy Services offerings, Honeywell's goal is to form a long term partnership for the purpose of meeting your current infrastructure needs by focusing to:

- Improve Operational Cost Structures
- Ensure Satisfaction
- Upgrade Infrastructure While Reducing Costs
- Meet Strategic Initiatives
- Leverage Teamwork
- Pursue Mutual Interests
- Provide Financing Options

How does it work?

Under an energy retrofit solution, Honeywell installs new, energy efficient equipment and optimizes your facility, as part of a multi-year service contract. Most of these improvements are cost-justified by energy and operational savings. Some of the energy conservation measures provide for a quick payback, and as such, would help offset other capital intensive energy conservation measures such as, boilers, package rooftop units, domestic hot water heaters, etc. The objective is to provide you with reduced operating costs, increased equipment reliability, optimized equipment use, and improved occupant comfort.

After review of the utility analysis, you can authorize Honeywell to proceed with the development of a detailed engineering report. The report development phase allows Honeywell to prepare an acceptable list of proposed energy conservation measures, which are specific to the selected facility. Some examples of typical Energy Conservation Measures include:

- Lighting
- Control Systems
- Destratification Fans
- Computer Power Management
- Building Enevelope
- Package Rooftop Units
- Domestic Hot Water Heaters
- Plug Load Management

Why Honeywell?

- Honeywell is one of the world leaders in providing infrastructure improvements
- With Honeywell as your building partner, you gain the advantage of more than 115 years of leadership in building services
- Honeywell has the infrastructure and manpower in place to manage and successfully implement your projec
- Honeywell has over 30 years experience in the energy retrofit marketplace with over $5 Billion in custome energy savings
- Honeywell provides you with "Single Source Responsibility" - from Engineering to Implementation, Servicing and Financing (if desired)

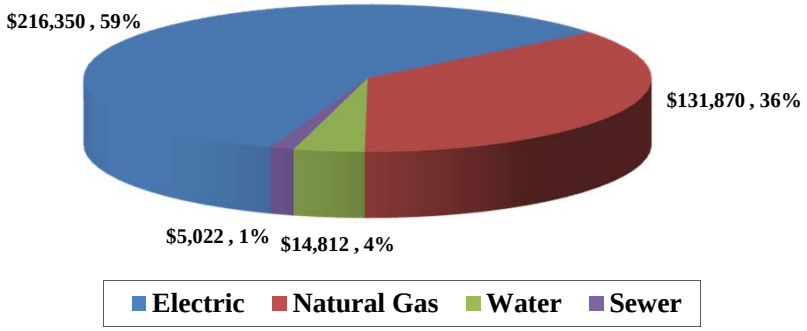
Historical Summary

Utility Analysis Period:
September 2017 - August 2018

	Current Year (9/17 - 8/18)			
	Electric	**Therms (Gas)**	**Water**	**Sewer**
Utility Costs*	$216,350	$131,870	$14,812	$5,022
Utility Usage (kWh, Therms, kGal)	1,759,680	134,036	2,497	2,497
$ Cost/Unit (kWh, Therms, kGal)	$0.12	$0.98	$5.93	$2.01
Electric Demand (kW)	6,575			

* Costs include energy and demand components, as well as taxes, surcharges, etc.

Actual Cost by Utility - 9/17 - 8/18



Total Cost = $368,054

Energy Benchmarking

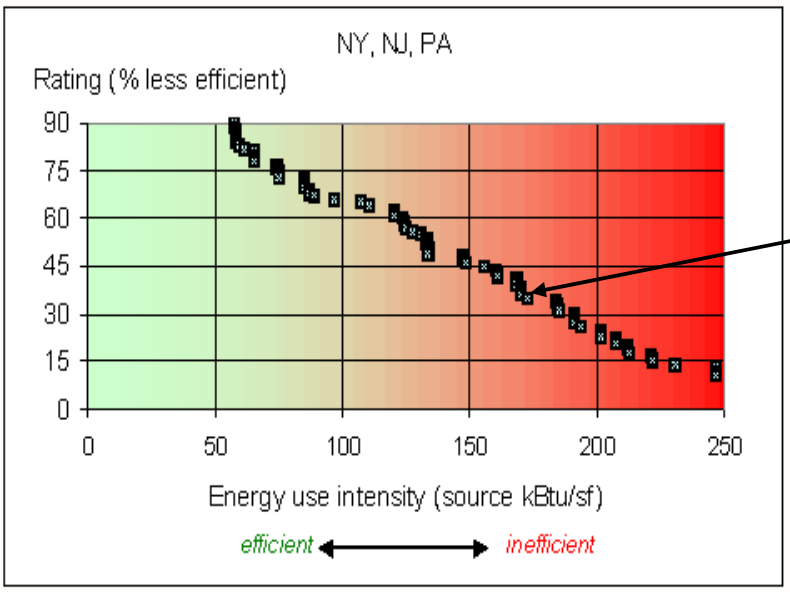
The calculation of EUI (Energy Use Intensity) is shown below. EUI, expressed in kBtu/sf, is normalized for floor area, the most dominant influence on energy use in most buildings. Its use usually provides a good approximation of how your building's energy performance compares to others. Site EUI indicates the rate at which energy is used at your building (the point of use). Source EUI indicates the rate at which energy is used at the generation sources serving your building (the point of source) and indicates the societal energy penalty due to your building The lower the EUI, the higher the rating, indicating that the building is more efficient than other buildings. The greater the EUI, the lower the rating, indicating that there is an opportunity for higher potential benefits from operational improvements.

The Source EUI below has been applied to a Department of Energy statistical model from the Oak Ridge National Laboratory web site, http://eber.ed.ornl.gov/benchmark. The Department of Energy has estimated energy use and cost reductions for building source EUI ratings (percentiles) in the table below. Please see the DOE Regional Source EUI Comparison graph below to rate your building in relation to the regional distribution of similar type buildings. (Note: The Source EUI includes the inefficiencies of electrical generation and transmission. A reduction in 'electrical' source EUI includes a benefit in terms of reduction of air pollution emissions and green house gases, and is thus an indicator of societal benefit.)

Source EUI Rating for your Building	Energy use and cost reduction potential (%)	Walk-thru energy assessment recommended?
above 60%	below 25%	No
40 to 60%	20 to 35%	Maybe
20 to 40%	35 to 50%	Yes
Below 20%	above 50%	Definitely

	Building	Annual Total Electrical Use (kWh)	Annual Total Non-Electrical Fuel Use (Therms)	Building Gross Floor Area (sq-ft)	Site EUI Rating	Source EUI: Annual Total Source Energy Use per Sq-Ft (kBtu/sf)	Rating (Regional Source EUI Comparison)
1	Building 1/2/3/5/6	1,162,560	88,674	125,715	**102**	**166**	**0.38**
2	Building 4	597,120	45,363	63,099	**104**	**170**	**0.40**

School Facilities

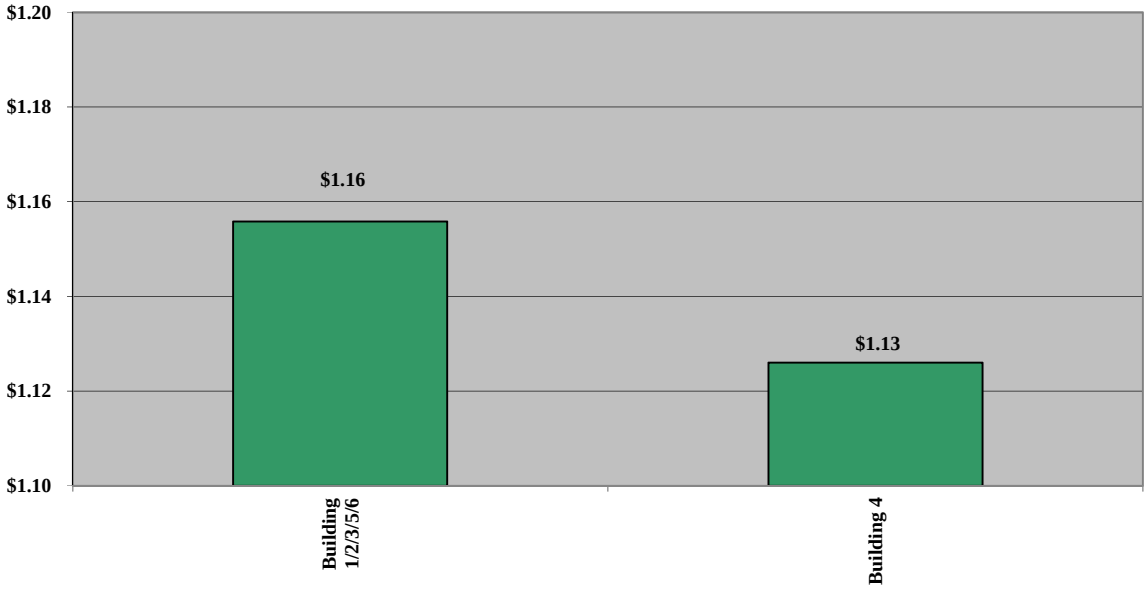


Source EUI	Est Regional Rating	Building
166	38%	Building 1/2/3/5/6
170	40%	Building 4

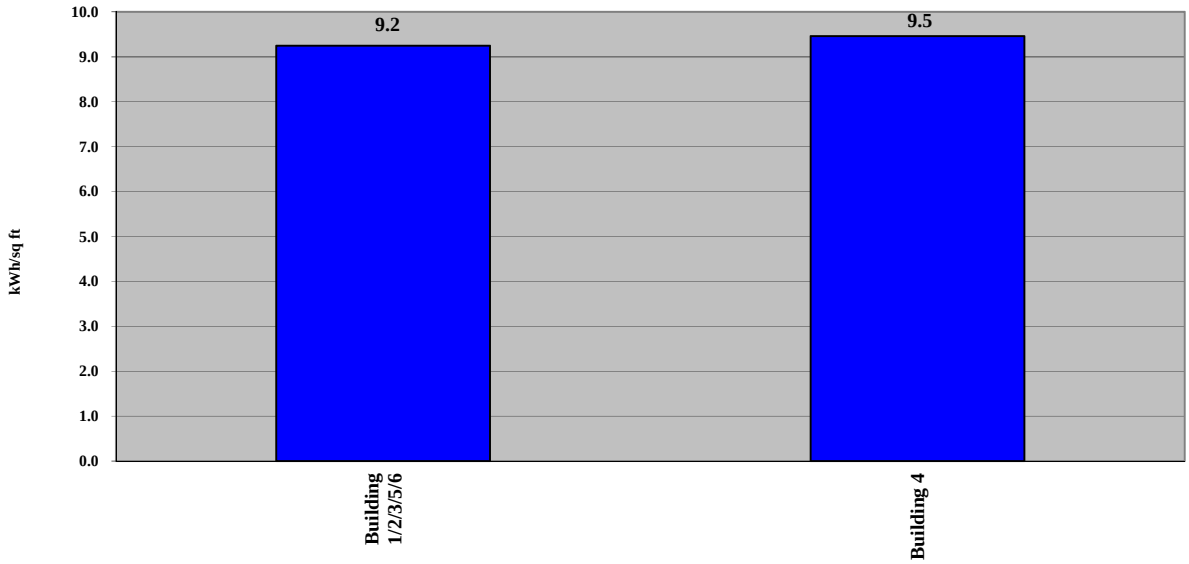
Utility Analysis - Electric

Square Footage Analysis

Cost per Sq. Ft.



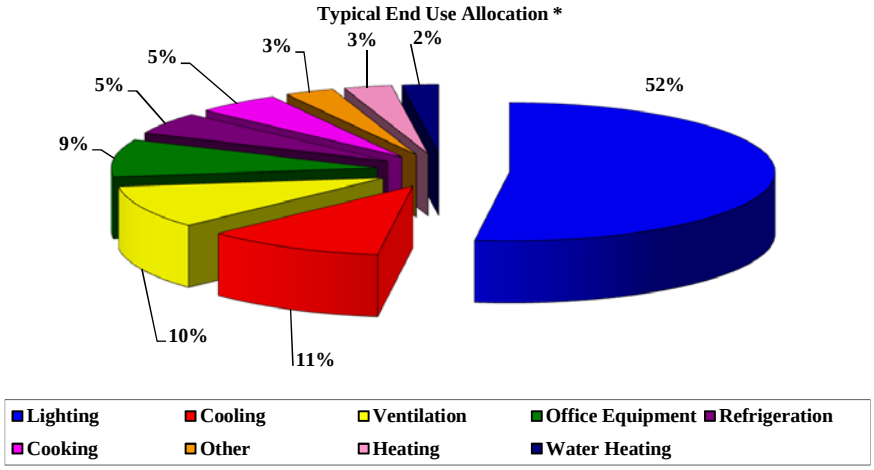
Usage (kWh) per Sq. Ft.



Average annual kWh/SF usage for Schools in this climate zone is 8.7.

Utility Analysis - Electric

Sources of Electric Consumption

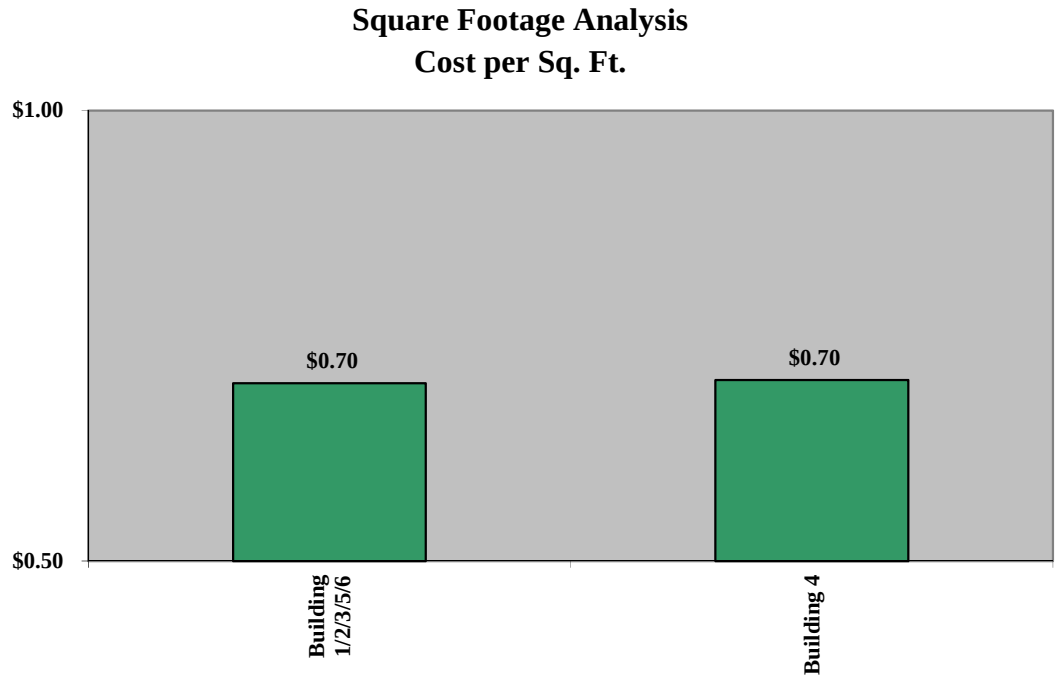


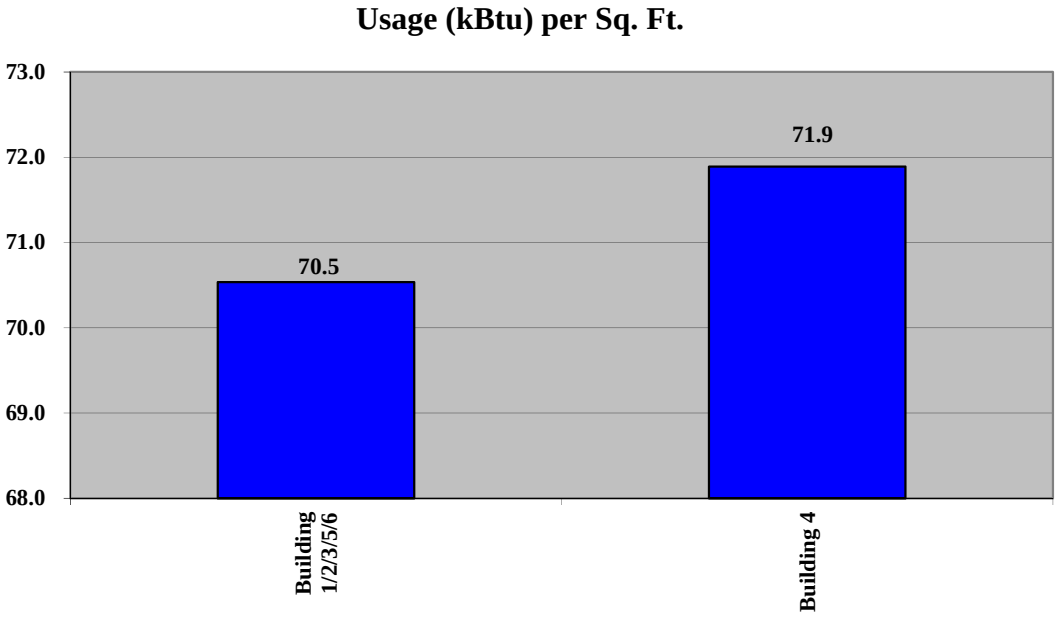
**This allocation is generic and is not a representation of the actual end use in your buildings included in this report.

Typical Allocation Applied to Your Electric Cost**

Lighting	$112,718
Cooling	$23,582
Ventilation	$21,635
Office Equipment	$18,822
Refrigeration	$11,034
Cooking	$11,034
Other	$6,490
Heating	$6,274
Water Heating	$4,760
Your Total Cost	**$216,350**

Utility Analysis - Natural Gas



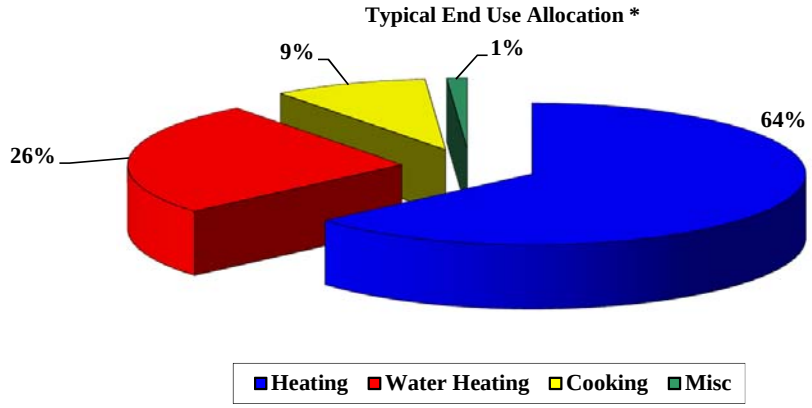


Average annual kBTU/SF usage for Schools in this climate zone is 52.1.

There is a fairly direct correlation between your gas usage and heating degree days, indicating that the vast majority of your natural gas usage is for space heating.

Utility Analysis - Natural Gas

Sources of Natural Gas Usage



**This allocation is generic and is not a representation of the actual end use in your buildings included in this report.

Typical Allocation Applied to Your Gas Cost**

Heating	$83,869.49
Water Heating	$34,418.14
Cooking	$12,000
Misc	$1,582
Your Total Cost	**$131,870**

Annual Emissions & Environmental Impact

Morris County Vocational School District

September 2017-August 2018

Based on the US Environmental Protection Agency -

Greenhouse Gas Equivalencies Calculator

http://www.epa.gov/cleanenergy/energy-resources/calculator.html

The following energy usage, cost and pollution have been quantified:

Total Annual Electric usage	1,759,680	kWh
Annual Natural Gas usage	134,036	Therms

Electric Emissions	
0.0007442	$MTeCO_2$ per kWh saved
Natural Gas Emissions	
0.05302541	$MTeCO_2$ per MMBtu saved
Equillivent Cars	
0.214132762	Cars/ 1MTeCO2
Forrested Acres	
1.1779029	Forested Acres Factor/ 1MTeCO2

Annual Greenhouse Gas Emissions (Metric tons of equivalent of CO2)		
eCO2 (Electric)	1,310	MT
eCO2 (Gas)	711	MT
Total eCO2	2,020	MT

This is equivalent to one of the following:	
433	No. of passenger vehicles - annual greenhouse gas emissions
2,379	No. of acres of U.S. forests - carbon sequestered annually



Potential Retrofits

Retrofit Description	Utility/Fuel Type	Common Recommendations for Action
Lighting Retrofit and Controls	Electric/Natural Gas	Upgrade Lighting and Controls
De-Stratification Fans	Electric/Natural Gas	Redistribution of Conditioned Air
DHW Boiler Replacements	Electric/Natural Gas	Higher Efficiency Units
RTU Replacements	Electric/Natural Gas	Higher Efficiency Units
Building Management System Upgrades	Electric/Natural Gas	Set-Back Equipment Scheduling
Building Envelope Improvements	Electric/Natural Gas	Reduce Building Leakage and Provide Better Comfort
Roof Replacements	Electric/Natural Gas	Provide Better Insulation
Computer Controllers	Electric	Put Computers to Sleep When Buildings are Unoccupied
Install Premium Efficient Motors	Electric	Provide More Efficient Motors and Variable Frequency Drives
Transformer Replacements	Electric	Provide More Efficient Transformers with Reduced Amounts of Excess Heat to the Spaces
Water Conservation	Water/Sewer	Lower Water Consumption
CHP	Electric/Natural Gas	Combined Heat and Power System
Solar PV	Electric	Lower Energy Supply Side Charges
Load Reduction	Electric	Lower Energy Supply Side Consumption

SECTION C ENERGY CONSERVATION MEASURES (ECMS)

Introduction

The information used to develop this Section was obtained through the independent energy audit building surveys to collect equipment information, interviews with operators and end users, and an understanding of the components to the systems at the sites. The information obtained includes nameplate data, equipment age, condition, the system's design and actual load, operational practices and schedules, and operations and maintenance history.

Honeywell has done a review of the Energy Conservation Measures (ECMs) which would provide energy and cost savings to the Educational Services Commission of NJ. This report aims to be an assessment of the feasibility and cost effectiveness of such measures, and an indication of the potential for their implementation. The ECMs listed below have been reviewed throughout your facilities for consideration within a complete Energy Savings Plan. What follows is a general description of the energy auditing process and the detailed descriptions of the Energy Conservation Measures for your facilities.

Energy Conservation Measures

ECM Description	Building 1/2/3/5/6	Building 4
1A LED Lighting	✓	✓
1B Destratification Fans	✓	
1C Vending Misers	✓	✓
1D Lighting Controls	✓	✓
2A DHW Boiler Replacements	✓	
2B RTU Replacements	✓	✓
2C Kitchen Equipment Replacements	✓	
2D Kitchen Hood Controls	✓	
2E Walk In Compressor Controls	✓	✓
3A Demand Control Ventilation	✓	✓
4A Building Envelope Improvements	✓	✓
4B Roof Replacement		✓
4C Window Replacements	✓	
5A Computer Power Management	✓	✓
6A Cogeneration CHP	✓	
7A Permanent Load Reduction	✓	✓
8A Solar PPA	✓	✓
9A Transformers		✓
10A Energy Education	✓	✓
11A Water Conservation	✓	✓

Overview

Honeywell has closely evaluated and audited the Morris County Vocational School District Board of Education in order to develop the optimum mix of energy saving measures. These selected site-specific measures have been developed using the following process:

- Review Site Audits
- Engineering Team Site Visits
- Develop Measures
- Review Measures with Team

Reject and Accept Measures Based On

- Alignment with Critical Success Factors (CSF)
- Value to the School
- Economic Financial Payback
- Equipment Service Life
- Effect on Current Space Conditions

In developing the proposed measures, the following considerations were critical:

- Reduction of space heating and cooling loads by performing a systems review, with complete consideration of current indoor environmental quality standards.
- Review and redesign lighting systems noting reductions in the internal heat gain in the affected spaces.
- Load reduction measures always precede optimization measures.

Bin weather data was used from a 15-year average reported from Morris County, NJ. Ventilation rates, taken from ASHRAE published standard, were predicted by using the building's population multiplied by cfm/person during occupied hours.

Reasonable infiltration rates were assumed based on the building's fenestration conditions and expected values for typical school buildings. A reduced infiltration rate was assumed for the unoccupied hours. Envelope heat loss calculations assumed a reasonable heat transmission rate (U value) based on the construction of the buildings. Wall area and glass area were estimated by supplied drawings and field photographs.

Demand Sensitive Operation

Review existing and proposed thermal loads. For example, the review process will facilitate the application of:

1. Optimized flow rates (steam, water, and air).
2. Optimized operation of equipment, matching current occupancy use profiles and considering both outside and indoor space temperatures.

Benefits of Mechanical Improvements

Listed below are some of the benefits that the school district would reap from the mechanical portion of the measures:

1. Avoid costly repairs and replace equipment that would have to be replaced in the next five years.
2. Improved compliance with ASHRAE Ventilation Standards.
3. Ability to trend ventilation rates; thus, insuring compliance through documentation.
4. Operating a more weather sensitive facility.
5. Allowing for a greater capability of central monitoring and troubleshooting via remote.
6. Greater operating flexibility to reduce costs and optimize staff efficiency.

Indoor Air Quality

Implementation of new energy-related standards and practices has contributed to a degradation of indoor air quality. In fact, the quality of indoor air has been found to exceed the Environmental Protection Agency (EPA) standards for outdoor air in many homes, businesses, and factories.

The American Council of Governmental Industrial Hygienists (ACGIH) in their booklet "Threshold Limit Values," has published air quality standards for the industrial environment. No such standards currently exist for the residential, commercial, and institutional environments, although the ACGIH standards are typically and perhaps inappropriately used. The EPA has been working to develop residential and commercial standards for quite some time.

Recent studies indicate that for even the healthiest students, indoor air pollution can reduce the ability to learn. As an example, if you were to place a number of students in a room where it's hot, there's little or no air circulation and other children are coughing and sneezing, exposing the student body to airborne related illnesses such as the cold or flu. Honeywell has addressed this issue by focusing on the proper operation and replacement of the unit ventilators and air handler equipment which will assure IAQ standards are met.

ECM 1A Interior Lighting Upgrades – LED Retrofit

The key benefits of this ECM include:

- Energy Savings from reducing total energy consumption with more efficient, state of the art technology. Today's most efficient way of illumination and lighting has an estimated energy efficiency of 80%-90% when compared to traditional lighting and conventional light bulbs.
- Improved teacher and student performance from enhanced lighting quality that translates to an enhanced working and learning environment.
- Improved equipment longevity by reducing amount of light usage and extending the useful life of your lighting system. LED bulbs and diodes have an outstanding operational life time expectation of up to 100,000 hours. This is 11 years of continuous operation, or 22 years of 50% operation. Operational savings in terms of bulb and ballast replacement are significant based on this technology.
- Reduced maintenance and operational costs by modernizing your lighting system and providing for longer lasting and technologically advanced lights, without the need to address deficient or bad ballasts.
- Ecologically Friendly - LED lights are free of toxic chemicals. Most conventional fluorescent lighting bulbs contain a multitude of materials like mercury that are dangerous for the environment. LED lights contain no toxic materials and are 100% recyclable, and will help to reduce carbon footprint by up to a third. The long operational life time span mentioned above means also that one LED light bulb can save material and production of 25 incandescent light bulbs. A big step towards a greener future!

ECM Description	Building 1/2/3/5/6	Building 4
1A LED Lighting	✓	✓

Existing Conditions

Building 1

Indoor lighting predominantly consists of standard T12s and T8s with some CFLs and incandescents in bathrooms and locker rooms. Typical classroom and office lighting is 2x4 T8 recessed troffer fixtures. The fitness center lighting consists of 2x2 recessed troffer fixtures with biax lamps. The gymnasium lighting consists of 8 lamp biax high bay fixtures. The majority of the fixtures found in the hallway areas are LED fixtures. Newer model LED exit signs are throughout the facility. The facility is controlled manually.

Building 2

Indoor lighting predominantly consists of standard T12s and T8s. Typical classroom and office lighting is 2x4 T8 recessed troffer fixtures. The majority of the fixtures found in the hallway areas are 1x3 T8 surface mounted wrap fixtures. Newer model LED exit signs are throughout the facility. The facility is controlled manually.

Building 3

Indoor lighting predominantly consists of standard T12s and T8s with some CFLs in the upper storage area. The high bay mercury vapor fixtures have been replaced with LEDs. Typical classrooms contain LED fixtures. Offices and bathrooms contain a majority of 1x4 T12 surface mounted wrap fixtures. Newer model LED exist signs are throughout the facility. The facility is controlled manually.

Building 4

Indoor lighting predominantly consists of standard T12s and T8s with some CFLs and incandescents in the culinary arts dining hall and bathrooms. Typical classroom lighting is 1x4 T12 standard wrap fixtures. Predominate fixture types in offices are 1x4 T12 standard wrap fixtures or 2x2 recessed troffer fixtures with biax lamps. Newer model LED exit signs throughout the facility. Exterior lighting consists of LED fixtures, linear fluorescent fixtures and compact fluorescent fixtures with plug-in lamps. The facility is controlled manually with the exception of certain classrooms that currently contain automated controls.

Building 5

Indoor lighting predominantly consists of standard T12s. Typical bay area lighting is 1x8 T12 industrial fixtures. Newer model LED exit signs throughout the facility.

Building 6

Indoor lighting predominantly consists of standard T8s and minimal T5s. Predominate fixtures in classrooms are either 1x8 T8 or 1x4 T8 indirect fixtures. Typical hallway lighting consists of compact fluorescent recessed can fixtures with plug-in lamps. The facility is controlled manually with the exception of certain areas such as certain classrooms and bathrooms that currently contain automated controls. Exterior lighting consists of high pressure sodium, metal halide and compact fluorescent fixtures.

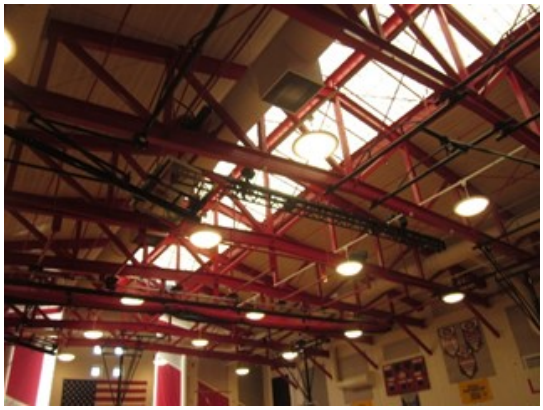
Guard Shack

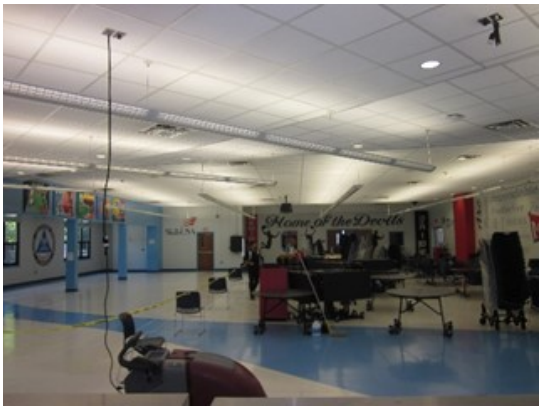
Indoor lighting predominantly consists of incandescent flood fixtures.

Scope of Work

The proposed lighting system is based on the recent investment grade lighting system audit where existing lighting systems were analyzed and inventoried. Honeywell proposes to retrofit all existing T-8 and T-12 fixtures with high efficiency Light Emitting Diode (LED) lamps.

The School District will receive many benefits from the lighting system upgrade.





Examples of existing lighting

To retrofit these lights with energy efficient LEDs, the existing ballasts that are located in the space behind the light will be removed. Once removed, replace them with LED drivers which will use approximately 24V and will not need the existing ballast. The existing lamps are removed and new energy efficient LED lamps are installed in their place. Replacements or maintenance is not required on these type fixtures for up to 100,000 hours or 15-20 years depending on usage time.

Changes in Infrastructure

New LED lamps will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use:	Energy savings will result from reduced electric energy usage. A slight increase in heating energy is resultant from the reduced heat output of more efficient lamps.
Waste Production:	All lamps and ballasts that are removed will be properly disposed.
Environmental Regulations:	No environmental impact is expected.

ECM 1B De-Stratification Fans

The key benefits of this ECM include:

- Improved efficiency & energy savings through more equal distribution of conditioned air space
- Equipment longevity due to lower utilization of equipment to condition air
- Increased comfort of occupants to improve productivity of students and teacher

ECM Description	Building 1/2/3/5/6	Building 4
1B Destratification Fans	✓	

Existing Conditions

Warm air stratifies close to the ceiling in high ceiling areas such as in the fitness center and gymnasium. Elevated levels of heat transfer through the high walls and roof causes elevated heat loss.





Proposed Solution

In areas with 20+ foot ceiling heights, there is approximately a 15°F+ temperature difference between the floor and the ceiling. With higher ceilings, it is even greater. That means to generate the heat necessary to maintain a comfortable 70°F temperature at the floor level, where student activities occur, the ceiling could be 85°F or higher.

De-stratification fans de-stratify the air to a zero to 3°F differential from floor to ceiling and wall to wall. This will allow HVAC systems to run for a shorter duration because of the absence of extreme temperatures to heat or cool, thus allowing the local thermostats to be satisfied for longer periods of time.

Systems Evaluation and Selection

An energy-efficient motor drives a near-silent fan that forces a column of hotter air from the ceiling area to the cooler floor below. As this column of warm air nears the floor, it begins to flare out in a circular pattern and rise again creating a torus. While doing so, it warms the cooler air and mixes with air near the floor, increasing the temperature and comfort of occupants. Through a natural law of physics, this torus will continue to re-circulate air, mixing warmer air from the ceiling with cooler air near the floor until the ceiling and air temperatures are nearly equal. As this happens, it will require less and less energy to comfortably heat the work area, allowing thermostats to be lowered and energy savings to be realized. Once started, the entire process of "thermal equalization" will take on average less than 24 hours.

Based on a site investigation conducted by our staff, we propose to install the following as indicated in the following table:

Building	Location	Qty	Type
Building 1	Fitness Center	5	Air Pear 15
Building 1	Gymnasium	3	Air Pear 45
Building 1	Gymnasium	6	Air Pear 25

Building	Location	Qty	Type
Total		14	

Table 1B.1 – Proposed De-Stratification Fans

Scope of Work

Per De-Stratification Fan:

- Shut off the main electric power to the area in which the unit(s) will be installed.
- Install new de-stratification fan and wiring.
- Re-energize.
- Inspect unit operation by performing electrical and harmonics testing.

Changes in Infrastructure

New de-stratification fans will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced thermal energy usage. A slight increase in electrical energy is resultant from the increase run time of the fan motors.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 1C Vending Misers

The key benefits of this ECM include:

- Energy Savings by better managing the power consumption of electrical equipment
- Longer equipment life thanks to reduced usage

ECM Description	Building 1/2/3/5/6	Building 4
1C Vending Misers	✓	

The Morris County Vocational School District has plug loads for equipment such as vending machines at multiple locations. As such, Honeywell has investigated the use of vending misers for these areas.

Existing Conditions

Vending machines are located throughout your facilities offering soft drinks to the occupants. A typical cold drink machine consumes over 5,000 kWh annually.





Building	Type	Location	Qty
Building 1	Cold Beverage	Cafeteria	1
Building 1	Snack	Cafeteria	1
Building 1	Snack	Gymnasium	1
Building 4	Cold Beverage	Roof Access-Storage	1
Building 4	Snack	Roof Access-Storage	1
Total			5

Table 1C.1 – Existing Vending Machines

Proposed Solution

During the site visit, Honeywell noted vending machines providing an opportunity for energy savings by shutting off non-critical loads during the non-occupied periods.

Utilizing a Passive Infrared (PIR) Sensor, the VMOC completely powers down a vending machine when the area surrounding it is unoccupied. Once powered down, the VMOC will monitor the room's temperature and use this information to automatically re-power the vending machine at one to three hour intervals, independent of occupancy, to ensure proper vending product temperature control.

The VMOC also monitors electrical current used by the vending machine. This ensures that the unit will never power down a vending machine while the compressor is running, so a high head pressure start never occurs. In addition, the current sensor ensures that every time the vending machine is powered up, the cooling cycle is run to completion before again powering down the vending machine. The Coca Cola Company and Pepsi Corporation approve the proposed controller for use on their machines.

Interface with Existing Equipment

All of the plug load control devices are easily installed. The vending machine controllers are installed separately from the machine, and implementation will occur during working hours. A period of three (3) weeks will be required to verify proper calibration of the sensors.

With respect to the vending machines in your facilities, Honeywell has estimated the number and types of vending machines based on our site tour. During the implementation phase, Honeywell will check with the vendor about the type and specification of the vending machines as it relates to any internal time clocks which may exist inside the machine. Should this be the case, the savings and cost will be adjusted accordingly.

Changes in Infrastructure

New vending machine controls will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Minor coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 1D Lighting Controls

The key benefits of this ECM include:

- Energy Savings from reducing total energy consumption with more efficient, state of the art technology. Today's most efficient way of illumination and lighting has an estimated energy efficiency of 80%-90% when compared to traditional lighting and conventional light bulbs.
- Improved equipment longevity by reducing amount of light usage and extending the useful life of your lighting system. Operational savings in terms of bulb and ballast replacement are significant based on this technology.
- Reduced maintenance and operational costs by modernizing your lighting system and providing for longer lasting and technologically advanced lights, without the need to address deficient or bad ballasts.

ECM Description	Building 1/2/3/5/6	Building 4
1D Lighting Controls	✓	✓

Existing Conditions

Educational institutions, such as K- 12 Districts, are focused on providing classrooms and campuses for their teachers and students that are safe, healthy, energy-efficient and provide the best environment for learning. And they are also chartered with reducing the costs of building operations. Current conditions do not allow for remote operation of the lighting systems within the buildings. The purpose of the survey was to identify areas in which occupancy based lighting controls can be used to conserve lighting energy.



Typical Lighting Occupancy Sensor

Proposed Solution

Honeywell proposes to install a comprehensive occupancy sensor control system that will monitor occupancy and turn lights off when spaces are not in use.

Occupancy sensors will be installed in classrooms and individual offices that do already have these sensors. The larger spaces will have multiple sensors that will automatically turn lights off when the spaces are unoccupied. Installing new wall switch or ceiling-mount occupancy sensor controls can save approximately 30% in energy use (based on historical savings averages for this type of facility). These new sensors will contain the latest dual-sensor technology (passive infrared & ultrasonic activated). The ultrasonic aspect of the sensor will detect "minor" motion while the passive infrared aspect will detect "major" motion. Based on observation, there were lights on in some unoccupied rooms, further highlighting the need for and potential energy savings from this ECM.

The following are some of the typical room and area types that are part of this proposal and the products that are likely to be used:

- Private Offices – In most cases, sensors will be wall switch applications. Sensors will be PIR or dual technology.
- Classrooms/Open Offices – Ceiling mounted sensors and/or corner mounted wide view sensors both with power packs. Sensors will be either Passive Infrared (PIR) or dual technology.

Honeywell will control the load specified in the proposal and the occupancy sensors installed will control the lighting fixtures to the unique needs of your school district.

Changes in Infrastructure

New sensors will be installed as part of this ECM.

Customer Support and Coordination with Utilities

Coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced electric energy usage.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 2A Domestic Hot Water Boiler Replacements

The key benefits of this ECM include:

- Reduced energy usage from improved boiler efficiency thanks to replacement of older equipment
- Lower operational costs through less frequent maintenance and operational issues

ECM Description	Building 1/2//3/5/6	Building 4
2A DHW Boiler Replacements	✓	

Existing Conditions

The existing domestic hot water heaters are generally in good condition but are not high-efficiency units.





Building	Manufacturer	Model	Qty	Capacity MBH	Storage (Gal)	Fuel
Building 3	State	SBT80500NE7F	1	400	80	Gas

Table 2A.1 – Existing Boiler Equipment

Proposed Solution

Honeywell proposes replacing the existing DHW heater at the above building with highly efficient condensing DHW heaters. New condensing DHW heaters have efficiencies between 92% - 94%. They provide better control with capabilities as night setback, temperature adjustments and demand control hot water.

Building	Manufacturer	Model	Qty	Capacity MBH	Storage (Gal)	Fuel
Building 3	AO Smith	BTH300A200	1	270	120	Gas

Table 2A. 2 – Proposed Equipment

Scope of Work

The following outlines the domestic hot boiler replacement:

- Demolish and remove old water heaters
- Furnish and install condensing gas fired domestic hot water heaters as specified in the table above
- Install all required piping, controls, and breeching
- Install mixing valve
- Install circulators for building use and kitchen supply
- Test and commission

Energy Savings Methodology and Results

The savings are calculated from the domestic hot water heater efficiency differences.

Existing Boiler Efficiency	= Existing Boiler Efficiency + Existing Heat Exchanger Efficiency
Proposed Boiler Efficiency	= Efficiency of the New Domestic Hot Water Heater
Energy Savings $	= DHW Load x (Existing Equipment Efficiency – New Equipment Efficiency)

Changes in Infrastructure

A new controller for each boiler will be installed and programmed. In addition to the controllers, training for maintenance personnel will be required.

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment that may be utilized. Honeywell and the Customer will determine final selections.
Equipment Identification	As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Utility Interruptions

Proper phasing procedures will minimize gas interruptions.

Environmental Issues

Resource Use	Energy savings will result from improved thermal efficiency.
Waste Production	All removed equipment will be properly disposed.
Environmental Regulations	No environmental impact is expected.

ECM 2B Rooftop Unit Replacements

The key benefits of this ECM include:

- Improved efficiency & energy savings through replacement of old, end of useful life equipment
- Equipment longevity due to more efficient and less wasteful equipment utilization

ECM Description	Building 1/2/3//5/6	Building 4
2B RTU Replacements	✓	✓

Existing Conditions

Some Rooftop Units (RTUs) serving the schools marked above are inefficient or past their useful lives. Replacing these units with new, high efficiency units will save energy costs over the long term while reducing repair costs that would otherwise have been necessary to keep the old RTUs in operation.





Building	Make	Model	Location Served	Qty.	Tons
Building 1	Addison	DC360M033	Cafeteria	1	30.0
Building 1	Addison	DC048G096	Faculty Dining	1	4.0
Building 1	Des Champs	PV-MZP-8703	Gym/Locker Rooms	1	15.0
Building 4	Des Champs	PV-MZP-8703-PVR	Chemistry Lab 410	1	15.0
Building 4	Des Champs	PV-MZP-8703-PVR	Biology Lab 412A	1	15.0

Table 2B.1 – Existing Rooftop Units to be Replaced

Proposed Solution

Honeywell proposes replacing the existing rooftop units in the above Table. The new units will be installed in the same location as the existing units. Existing electrical power supply will be reconnected to the new motors. The new units will be equipped with factory-installed microprocessor controls that improve unit efficiency. The units will also communicate with the building management system.

Building	Make	Model	Location Served	Qty.	Tons
Building 1	Daikin	MPS-030	Cafeteria	1	30.0
Building 1	Daikin	DPS-004	Faculty Dining	1	4.0
Building 1	Daikin	MPS-015	Gym/Locker Rooms	1	15.0
Building 4	Daikin	MPS-015	Chemistry Lab 410	1	15.0
Building 4	Daikin	MPS-015	Biology Lab 412A	1	15.0

Table 2C.2 – Proposed Condensing Units

Scope of Work

The following outlines the scope of work to install the condensing units stated in the above table:

- Disconnect existing electric connections.
- Disconnect piping from the unit.
- Remove unit from the base.
- Modify base for new unit if necessary.
- Run new gas line for gas fired heater.
- Rigging and setting new unit at the base.
- Inspect piping before reconnecting them to the unit.
- Reconnect piping.
- Repair piping insulation.
- Connect electric power.
- Start up and commissioning of new unit.
- Maintenance operator(s) training.

Energy Savings Methodology and Results

The savings approach is based on the energy efficiency between the existing and new units. The savings are generally calculated as:

Electric Energy savings	Existing unit energy consumption (kWh) – replacement unit energy consumption (kWh)

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the School District will determine final selections.
Equipment Identification	Product cut sheets and specifications are available upon request. As part of the measure, design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the electrical tie-in will be required.

Environmental Issues

Resource Use	Energy savings will result from higher efficiency units.
Waste Production	Existing rooftop unit scheduled for removal will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2C Kitchen Equipment Replacements

The key benefits of this ECM include:

- Energy Savings from reducing total energy consumption
- Equipment longevity due to more efficient and less wasteful equipment utilization.

ECM Description	Building 1/2/3//5/6	Building 4
2C Kitchen Equipment Replacements	✓	

Existing Conditions

The school's kitchen uses an electric dishwasher booster to raise water temperature high enough for sanitization. The building typically uses this equipment for about 800 to 1200 hours per year.





Table 2C.1– Existing Kitchen Equipment to be Replaced

Building	Equipment	Qty	Manufacturer	Model	KW
Building 1	Convection Oven	1	Vulcan	VC66E	25
Building 1	Dishwasher Booster Heater	1	Hatco	C-15	15

Table 2C.1– Existing Kitchen Equipment to be Replaced

Proposed Solution

Honeywell is proposing to replace the existing electric kitchen equipment listed in the table above. Natural gas is available in the kitchen and could be used instead of electricity. Implementation would require new gas fired equipment. Monetary cost savings would be achieved through the lower cost of natural gas versus the higher cost of electricity.

Building	Equipment	Qty	Manufacturer	Model	MBH
Building 1	Convection Oven	1	Vulcan	VC66G	100
Building 1	Dishwasher Booster Heater	1	Hatco	PMG-100	105

Table 2C.2– New Gas Fired Equipment

Scope of Work

The following outlines the scope of work to install the kitchen equipment stated in the above table:

- Disconnect existing electric connections
- Remove kitchen equipment

- Run new natural gas piping to kitchen equipment
- Inspect piping before connecting to the new kitchen equipment
- Connect natural gas piping
- Start up and commissioning of new equipment
- Maintenance operator(s) training

Energy Savings Methodology and Results

The savings approach is based on the energy efficiency between the existing and new units. The savings are generally calculated as:

Energy savings	Current Electrical Consumption – Proposed Thermal Consumption

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. Honeywell and the School District will determine final selections.
Equipment Identification	Product cut sheets and specifications are available upon request. As part of the measure, design and approval process, specific product selection will be provided for your review and approval.

Customer Support and Coordination with Utilities

Coordination of the natural gas tie-in will be required.

Environmental Issues

Resource Use	Energy savings will result from conversion of electric to natural gas.
Environmental Regulations	No environmental impact is expected.

ECM 2D Kitchen Hood Controls

The key benefits of this ECM include:

- Reduced energy usage from reduced exhaust air flows.
- Reduced maintenance costs to replacing fan motors and adding VFDs.
- Lower operational costs through less frequent maintenance and operational issues

ECM Description	Building 1/2/3//5/6	Building 4
2D Kitchen Hood Controls	✓	

Existing Conditions

Your kitchens utilize a constant volume kitchen exhaust hood system. This system operates at full load, even when there is no activity in the kitchen. It also requires operating the exhaust fan at full load. This wastes both fan energy and heating energy. When the hood is not utilized, an opportunity exists to reduce airflow and conserve energy.





Proposed Solution

Honeywell recommends installing a microprocessor based controls system whose sensors automatically regulate fan speed based on cooking load, time of day and hood temperature while minimizing energy usage. The system includes a temperature sensor installed in the hood exhaust collar, IP sensors on the ends of the hood that detect the presence of smoke or cooking effluent and variable frequency drives (VFD) that control the speed of the fans. This will result in energy and cost savings, noise reduction, longer equipment life and reduction in cleaning costs.

Building	Number of Hoods
Building 1	3

Scope of Work

- Install a temperature sensor in the hood to monitor temperature of the exhaust gas.
- Install a set of two photo sensors on the sides to monitor smoke density across the hood.
- Install a control panel with a small point controller and a set of relays in the kitchen close to the hood.
- Provide electric wiring from the new panel to the sensors, exhaust fan motor as well as to the closest electric panel for power supply.
- Commission control components and sequences, and calibrate control loops.

Sequence of operation will enable the exhaust fans when either temperature or smoke density in the range hoods is above a pre-set value. Time delays between start and stop will be programmed to prevent motor short cycling. Schedule programming could be implemented as well.

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of conditioned air that is being exhausted when there is no cooking taking place.

Changes in Infrastructure

There will be improvements in HVAC equipment and controls for not operating fans continuously.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 2E Walk-In Compressor Controls

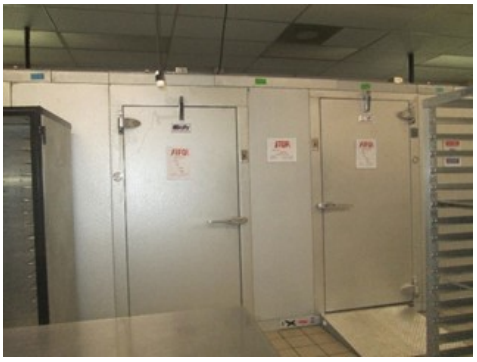
The key benefits of this ECM include:

- Energy Savings from improved cycle time of existing compressors.
- Reduced maintenance on compressor units.
- Operational savings through less frequent maintenance and operational issues.

ECM Description	Building 1/2/3//5/6	Building 4
2E Walk In Compressor Controls	✓	✓

Existing Conditions

In many refrigeration, walk-in freezers and coolers, the compressor is oversized and cycles on/off frequently. This compressor cycling results in higher energy consumption and may reduce the life of the compressor.





Building	Location	Walk-In Refrigerators	Walk-In Freezers
Building 1	Kitchen	1	1
Building 4	Kitchen	1	1

Table 2E.1 – Existing Walk-In Refrig/Freezers to be installed with Controllers

Proposed Solution

Honeywell will install a controller refrigeration sensor manufactured by Intellidyne at the above-mentioned buildings to reduce the compressor cycles of the kitchen walk-in coolers and freezers. The installation of this ECM will have no negative impact on system operation or freezing of food products. By reducing the cycling, the sensor will improve operating efficiency and reduce the electric consumption by 10% to 20%.

This control enhancement will save energy through the reduced compressor cycling in the kitchen walk-in coolers and freezers and will extend the operating life of the compressor. Consequently, the compressor will not have to be replaced as often.

Intellidyne Sensor Features

- Automatic restart on power failure
- Surge protection incorporated into circuitry
- Fully compatible with all energy management systems
- UL listed
- Maintenance free

Intellidyne Sensor Benefits

- Patented process reduces air conditioning electric consumption typically 10% to 20%

- Increased savings without replacing or upgrading costly system components
- "State-of-the-art" microcomputer controller – LED indicators show operating modes
- Protects compressor against momentary power outages and short cycling
- Simple 15-minute installation by qualified installer
- No programming or follow-up visits required
- Maximum year-round efficiency
- Reduces maintenance and extends compressor life
- Fail-safe operation
- Guaranteed to save energy
- UL listed, "Energy Management Equipment"

Intellidyne's patented process determines the cooling demand and thermal characteristics of the entire air conditioning system by analyzing the compressor's cycle pattern, and dynamically modifies that cycle pattern to provide the required amount of cooling in the most efficient manner. This is accomplished in real-time by delaying the start of the next compressor "on" cycle, by an amount determined by the cooling demand analysis. These new patterns also result in less frequent and more efficient compressor cycles.

Energy Savings Methodology and Results

The energy savings for this ECM is realized by the reduction in run time of the compressors and fan motors in the freezers/refrigerators.

Changes in Infrastructure

None

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from the reduced electrical consumption of the compressor.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 3A Demand Control Ventilation

The key benefits of this ECM include:

- Operational efficiency thanks to better control and reduced outside air.
- Energy Savings from reducing total energy consumption with more efficient, state of the art technology.
- Equipment longevity due to more efficient and less wasteful equipment utilization.
- Occupancy comfort and productivity by way of enhanced temperature and humidity control throughout your buildings.

ECM Description	Building 1/2/3/5/6	Building 4
3A Building Management System Upgrades	✓	✓

Existing Systems

Morris County Vocational School District has a "District Wide" Building Management System (BMS) furnished, installed and serviced by AME Inc. The BMS is a Honeywell system.

The following is a summary of the major HVAC equipment that is monitored and controlled by the BMS.

	Building #	HVAC Equipment
A	Building 1	1. Rooftop Units 2. Make-up Air Units 3. Zone Dampers 4. Exhaust Fans
B	Building 2	1. Rooftop Units 2. Boilers 3. Radiant Heat
C	Building 3	1. Air Handling Units 2. Boilers 3. Unit Ventilators
D	Building 4	1. Boilers 2. Air Handling Units 3. Rooftop Units 4. Unit Ventilators 5. Cabinet Unit Heaters 6. Variable Air Volume Boxes 7. Radiant Heat 8. Exhaust Fans
E	Building 5	No equipment is connected to the BMS.
F	Building 6	1. Rooftop Units 2. Boilers 3. Radiant Heat 4. Variable Air Volume Boxes

The HVAC units serving one zone spaces such as the Building 3 and Building 4 classrooms were designed for peak occupancy conditions to supply outside air to the space with return air from space being exhausted. Most of the time these spaces are not fully occupied, which increase energy demand for heating and cooling of excessive amount of outside air.

Scope of Work

Honeywell will install CO_2 sensors at the below locations. The CO_2 sensors will provide the control signal for the air handlers to optimize the quantity of fresh air required. The installation of CO_2 sensors will read the levels of CO_2 in the space and ensure that only the required outside air is supplied and heated to meet the minimum outdoor air requirements. This control strategy will reduce the amount of outside air intake and thus reduce the heating energy used by the air handling units. Based on this fact, there are reduced requirements for outside air to the spaces.

Building	Area Served	Number of Units	CFM Total (each unit)
Building 1/2/3/5/6	Room 301 – Music Band	1	1,500
Building 1/2/3/5/6	Room 302A – Veterinary Science	1	8,000
Building 1/2/3/5/6	Room 303 – Building Construction	1	4,000
Building 1/2/3/5/6	Room 304 – Carpentry	1	7,000
Building 1/2/3/5/6	Room 305 – Electrical Trades	1	7,000
Building 1/2/3/5/6	Room 306 – Plumbing	1	4,000
Building 1/2/3/5/6	Buildings & Ground Office	1	5,000
Building 4	Room 401 A	1	1,500
Building 4	Room 402 A	1	1,500
Building 4	Room 403 A	1	1,500
Building 4	Room 404 A	1	1,500
Building 4	Room 405 A	1	1,500
Building 4	Room 408 A	1	1,500
Building 4	Room 409 A	1	1,500

Table 3A.1 – Existing units to utilize CO_2 sensors

Energy Savings Methodology and Results

The savings approach is based upon reducing the amount of energy that needs to pre-heat or cool the outside air. The savings are generally calculated as:

Existing Heating BTU & Cost per BTU	= Metered data from existing meter readings
Cost of Existing Heating	= Average site data $/CCF or $/Gallon
Reduction in Heating/Cooling BTU	= Reduction in outside air CFM x 1.08 x Delta T x Operating Hours
Cost of Proposed Heating/Cooling	= Reduced BTU x Cost per BTU
Energy Savings $	= Existing Costs – Proposed Costs

The baseline adjustment calculations are included with the energy calculations.

Changes in Infrastructure

None.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	Energy savings will result from reduced energy.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4A Building Envelope Improvements

The key benefits of this ECM include:

- Energy Savings from reducing unwanted outside air infiltration
- Equipment longevity due to more efficient and less wasteful equipment utilization
- Occupancy comfort and productivity by way of enhanced temperature and humidity control throughout your buildings
- Improved building envelope from addressing building gaps that allow unconditioned air penetration

ECM Description	Building 1/2/3//5/6	Building 4
4A Building Envelope Improvements	✓	✓

Existing Conditions

Heat loss due to infiltration is a common problem, particularly in places with long and cold winter seasons such as New Jersey. This problem has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Our work has found 30% to 50% of heat loss attributable to air leakage in buildings.

In the course of our building examination, Honeywell uncovered a number of leaks that allow for heat loss to occur during the winter season and unwanted heat gains during the summer season. These problems include door gaps and lack of air sealing and insulation.

Honeywell has helped customers such as you to address these problems with a comprehensive and thorough building envelope solution that seals up your buildings to improve occupancy comfort and help eliminate unwanted energy waste. We propose to conduct a comprehensive weatherization job to weatherproof doors, caulk and seal leaks, and install spray foam and rigid foam boards to stop unwanted air movement and provide a thermal barrier between spaces.





Proposed Solution

Beyond representing significant energy savings potential, uncontrolled air leakage can affect occupancy comfort, air quality, the imbalance of mechanical systems, and the potential for compromised structural integrity of the building envelope from moisture migration. Control of air leakage involves the sealing of gaps, cracks and holes, using appropriate materials and systems to help create a continuous plane of “air-tightness” to completely encompass the building envelope. Part of this process also incorporates the need to “decouple” floor-to-floor, and to “compartmentalize” components of the building in order to equalize pressure differences. The buildings were inspected visually to identify both the location and severity of air leakage paths. Air leakage paths are detailed in the scope of work below. The envelope improvement repairs listed below are recommended to reduce air infiltration/exfiltration. This will result in energy savings and sustainability toward a longer building life.

Roof-Wall Joints

The buildings were found to require roof-wall joint air sealing. To address these problems, we recommend using a high performance sealant. In some buildings, a 2-component foam will be used. Any cantilevers off the buildings will be sealed with backer rod and sealant.

Doors

Many of your building doors require weather stripping and the installation of door sweeps to prevent air leakage. Weather-strip kits will be selected appropriate to the construction and style of the door and frame. Astragals (the molding that covers the gap between a pair of doors) will be replaced or installed on the double doors as well. Each of the doorways addressed will receive a new door sweep to optimize the seal at the bottom of the door.

Pipe Penetrations

There are pipe penetrations in Buildings 3 and 4 that show air leakage. These penetrations will be sealed with two-component polyurethane foam.

Benefits

This work will allow for more efficient operation of your buildings by reducing heating and cooling losses throughout the year. In addition, the draftiness of the buildings and hot and cold spots will be significantly reduced. A reduction in air infiltration will also minimize potential concerns for dirt infiltration or indoor air quality concerns including allergies.

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the buildings' HVAC equipment. The improved building envelope will limit conditioned air infiltration through openings in the building air barrier. Less infiltration means less heating required by the heating system.

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Some existing caulking and weather-stripping will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4B Roof Replacement

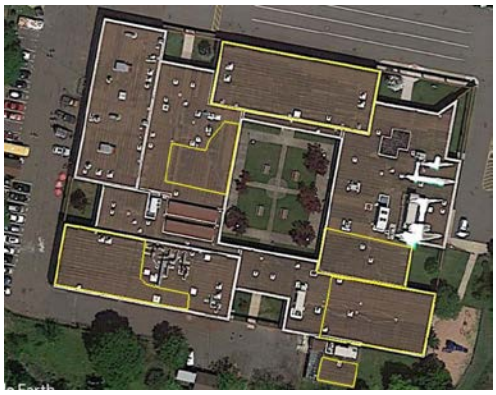
The key benefits of this ECM include:

- Energy Savings from reducing outside air infiltration that requires greater HVAC system utilization to overcompensate
- IAQ Issues Reduced by way of non-leaking roofs
- Occupancy comfort and productivity by way of enhanced temperature controls

ECM Description	Building 1/2/3//5/6	Building 4
4B Roof Replacement		✓

Existing Conditions

Your roofs were found to be in varying conditions, which is commonly observed given the age and number of buildings involved. Honeywell recommends replacement of sections of the Building 4 roof, based on the age of the roof and area designated for solar panels.



The rate of infiltration that occurs due to the leakage on the roof around perimeters and equipment curbing is a major cause of energy loss. Unwanted heat loss and heat gains, due to low R-value of the existing roof insulation, will be improved through the installation of energy efficient roofing materials. The upgrade will result in improved savings and comfort for those affected in the building.

Proposed Solution

Honeywell proposes the installation of a new energy efficient, Spray Polyethylene Foam (SPF) roofing material over the traditional Ethylene Propylene Diene Monomer (EPDM) single ply roof. The Poly Spray Foam Roof is one monolithic, self-flashing system with air barrier – no loss of effective R-value. Overall, through the implementation of this measure the district will reduce its heating fuel usage and air conditioning costs each year.

Building	Roof Area
Building 4	16,950

Table 4B.1 - Roof Replacement



New Spray Foam Roof Installation by Honeywell

Energy Efficiency

EPDM Single-ply roof with an initial R-Value of 18 will have a 15%+ loss in thermal resistance due to thermal shorts of steel fasteners. It will also help deliver a 10% increase in thermal transmittance when using single layer of insulation board. Finally, R-value and Air permeability of a deck, insulation and membrane has a major impact on System R-value. This will equate to an increase in final overall System R-value equal to 9.6.

Durability

Single-ply EPDM roofs will have a 45-mil water proofing layer, but will also have major fail points such as flashing, seams, fasteners and single-ply punctures. In contrast, the SPF roof will have a top coat plus SPF insulation, delivering water proofing to prevent future leaks.

Interface with Building

The new roof will be constructed to match the existing roof footprint, maintaining contours of the existing building.

Energy Savings Methodology and Results

The energy savings for this ECM are realized within the building's HVAC equipment. The improved building envelope will limit conditioned air infiltration through openings in the building air barrier. Less infiltration means less heating and cooling required by HVAC systems.

Following approach is used to determine savings for this specific measure:

Existing Roof Efficiency	= Existing U + Existing Infiltration Rate
Proposed Roof Efficiency	= Proposed U + Proposed Infiltration Rate
Energy Savings (Btu)	= UAdT proposed – UAdT existing
Winter Savings(Therms)	= Energy Savings/Boiler Eff./100,000
Summer Savings (Tons Cooling)	= Energy Savings/12,000 Btu/Ton

Changes in Infrastructure

Building envelopes will be improved with little or no noticeable changes.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Existing roof materials will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 4C Window Replacements

The key benefits of this ECM include:

- Energy Savings from reducing air loss and tightening up the windows to address air infiltration
- Equipment longevity due to more efficient and less wasteful equipment utilization
- Occupancy comfort and productivity thanks to tighter and more efficient windows

ECM Description	Building 1/2//3/5/6	Building 4
4C Window Replacements	✓	

Existing Conditions

The windows in Buildings 1 were found to be a combination of aluminum framed glass and wood frame vinyl clad single pane with built-in storm glass. The windows are in poor condition. Due to age, construction type, and condition, the windows incur excess air infiltration and provide average thermal resistance to heat transfer.





Proposed Solution

Honeywell proposes the installation of new energy efficient, double-paned windows to reduce infiltration, infrared and conductive losses. Overall, through the implementation of this measure, your district will reduce its heating fuel usage and cooling costs each year. The upgrade will result in savings and improved comfort to students and teachers which in turn will foster a better learning environment.

Building	Sq. Footage*	U-Factor Existing Window	U-Factor New Window	Type
Building 1	1,295 (101 Windows)	1.20	0.29	Double Pane Low E

Table 4C-1 – Window Replacements

*Recommended project only includes 181 square feet (~14 windows).

Energy Savings Methodology and Results

The energy savings for this ECM are realized at the buildings' HVAC equipment. The improved windows will limit conditioned air infiltration and exfiltration. Less infiltration and exfiltration means less heating and cooling required.

Following approach is used to determine savings for this specific measure:

Existing Window Efficiency	= 1/Existing R + Existing Infiltration Rate
Proposed Window Efficiency	= 1/Proposed R + Proposed Infiltration Rate
Energy Savings $	= Audit*Hours/boiler efficiency +((Existing Airflow – proposed airflow) x 1.08 (OA Avg. Temp – Inside Avg. Temp)/ (boiler efficiency) x (fuel cost)

Changes in Infrastructure

New windows will be installed.

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Energy savings will result from reduced HVAC energy usage and better occupant comfort.
Waste Production	Existing windows will be removed and disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 5A Computer Power Management

The key benefits of this ECM include:

- Energy savings by better managing the power consumption of computer equipment
- Longer equipment life thanks to reduced usage
- Security protection because external access can't occur when the computer system is shut down after hours
- Virus protection from the ability to shot down the computers before viruses reach the network

ECM Description	Building 1/2/3//5/6	Building 4
5A Computer Power Management	✓	✓

Existing Conditions

Information Technology (IT) is a major consumer of energy in school buildings and campuses. At more than 25 percent of total energy consumption energy efficient IT becomes less of a nice-to-have and more of a necessity. This ECM implements a power management system for all of your LAN based computers, printers and copiers throughout your buildings. The software system will automatically shut down your IT equipment at scheduled times to prevent unnecessary energy consumption during unoccupied hours.





Proposed Solution

Honeywell proposes computer power management software Surveyor by Verdiem to manage PC consumption from phantom power, providing a detailed breakdown of usage by IT device type so as to allow energy managers to better plan, manage and optimize an organization's overall power consumption. This ECM will also provide for enhanced staff productivity. Energy consumption of distributed IT devices can be reduced by up to 60%. Verdiem helps IT departments to accurately measure IT device energy consumption, enforce policies for greater energy efficiency, and optimize savings.



Building	No. of Computers
Building 1	185
Building 2	18
Building 3	5
Building 4	72

Building	No. of Computers
Building 5	-
Building 6	40
Totals	320

Energy Savings Methodology and Results

Annual savings for administrative and student computers are based on previous logging results for computers with similar usage types.

Changes in Infrastructure

VBOX server will be integrated into current IT network.

Customer Support and Coordination with Software

Support will be required for software deployment by IT department.

Environmental Issues

Resource Use	Annual savings for administrative and student computers are based on previous logging results for computers with similar usage types.
Waste Production	None.
Environmental Regulations	No environmental impact is expected.

ECM 6A Cogeneration Combined Heat and Power

The key benefits of this ECM include:

- Energy Savings from utilizing a combined heat and power system in place of the existing heating system
- Operational savings thanks to improved operational efficiencies unique to CHP technology
- Resiliency unique to CHP technology that will allow you to operate the building during emergency situations and grid disruptions.

ECM Description	Building 1/2/3/5/6	Building 4
6A Cogeneration CHP	✓	

Existing Conditions

The Morris County Vocational School District is currently served by natural gas and electric utilities. In addition, several of the existing boilers have been replaced or are planned to be replaced soon. The campus is a candidate for Combined Heat and Power since the facility is used for events year-round.

Proposed Solution

Honeywell recommends the installation of one 35 kW combined heat and power generating unit that will generate electric power and produce thermal energy that can supplement both heating and cooling loads. This system will be appropriate to this site given the year-round operational needs of this facility and leverage healthy state rebates to help pay for it.

Yanmar Cogen Unit

Yanmar's Combined Heat and Power system uses an internal combustion engine, powered by clean natural gas or propane, to produce both heat and electric power. The unit efficiency utilizes up to 88% of the fuel burn versus 33% burn rate of conventional, from-the-grid sources.



Scope of Work

Building	Qty	Make	Model
Building 3	1	Yanmar	CP35D1

Table 6A.1 – Recommended Cogeneration Unit

Equipment Information

Manufacturer and Type	Several quality and cost effective manufacturers are available. The following is an example of equipment being utilized. Yanmar CP35D1, Electrical Output 35 kW, Thermal Output 204,040 Btu/hr Honeywell and Morris County Vocational School District will determine final selections
Equipment Identification	Product cut sheets and specifications for generally used are available upon request. As part of the measure design and approval process, specific product selection will be provided for your review and approval.

Energy Savings Methodology and Results

Savings are based on energy conversion of natural gas to thermal and electrical energy.

Changes in Infrastructure

The proposed micro-generator would reside in Building 3.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods. The customer and Honeywell will decide the exact location of the cogeneration installation.

Environmental Issues

Resource Use	Renewable energy will be generated to supplement energy purchased from the electrical utility.
Waste Production	None.
Environmental Regulations	Aside from the environmental benefits from on-site energy generation, no other environmental impact is expected.

ECM 7A Permanent Load Shed Reduction Program

The key benefits of this ECM include:

- Energy Savings from reducing energy loads during peak hours
- Revenue generation from participation in the demand response program

ECM Description	Building 1/2/3/5/6	Building 4
7A Permanent Load Reduction	✓	✓

Existing Conditions

The PJM permanent load reduction program offers Morris County Vocational School District the ability to benefit from permanent kW load reductions associated with implementing Energy Efficiency (EE) improvements and generate a new revenue stream from participation.





Proposed Solution

Permanent Load Reduction

PJM offers incentives to customers who install energy-efficient equipment that permanently reduces the use of electricity during peak times. Documentation of the type of new energy-efficient equipment installed, when it was installed, and how it is being used is required. PJM also requires a measurement of electricity usage during the peak summer periods to verify whether or not a building is actually using less energy. Also, as a cooperative, PJM relies on its members to combine projects together to make sure the volume is significant enough to impact their system.

Honeywell has calculated savings based on load reduction through decreasing kW by installing LED lights in the table below:

Building	Load Reduction (kW)
Building 1	27
Building 2	6
Building 3	7
Building 4	36
Building 5	1
Building 6	22
Totals	99

Energy Savings Methodology and Results

Revenue is generated through participation in the PJM program.

Changes in Infrastructure

None.

Customer Support and Coordination with Utilities

Initiation of demand reduction participation will be required.

Environmental Issues

Resource Use	None.
Waste Production	This measure will produce no waste by-products.
Environmental Regulations	None.

ECM 8A Solar Power Purchase Agreement (PPA)

The key benefits of this ECM include:

- Reduced utility costs due to competitive Solar Power Purchase Agreement pricing
- Guaranteed utility rates for 15 years to provide a valuable hedge against future price volatility and deliver greater budgetary certainty utilizing clean electricity
- Additional savings from solar can provide the District with more potential ESIP funding to expand the overall project scope and include additional projects
- Educational asset to provide additional tools for teachers to engage students on sustainability and the environment
- Resiliency by way of battery storage potential that can let you operate buildings in island mode during grid disruptions
- Low risk given that maintenance is provided by the 3rd party system owner
- No upfront costs

ECM Description	Building 1/2/3/5/6	Building 4
8A Solar PPA	✓	✓

ECM Overview

Honeywell recommends that the District further assess the feasibility of a solar photovoltaic system on district owned land and buildings to generate on-site renewable electricity. This could be provided at no upfront cost via a power purchase agreement (PPA). A PPA is a public-private partnership financial arrangement in which a third party solar company owns, operates, and maintains your photovoltaic system, while the host customer agrees to provide the site for the system on its property. The solar system's power production is purchased by you for a predetermined price ($/kWh) and for a predetermined period of time. This stable price for electricity will be lower than the utilities and third party suppliers, thereby allowing you to benefit from cheaper electricity prices, on-site renewable energy generation, a reduction in greenhouse gas emissions and a powerful educational tool for your teachers and students. Meanwhile, the system will not add any additional maintenance costs since it is owned by the third party solar company. One of the more significant benefits of this potential ECM is that it will provide for a rate change, helping to deliver greater savings within your ESIP project to help fund other measures.

Honeywell will oversee the design, construction and help with the operations and maintenance of the system. We conducted a feasibility study during the investment grade audit, in conjunction with your technical consultant and legal team, we will provide RFP development, solicitation and oversight of the installation of a solar photovoltaic system.





Proposed Solution

Honeywell proposes to install the solar PPA system at the buildings listed in the chart below.

Building	Rating kW-DC
Building 1	297
Building 3	168
Building 4*	165
Building 5	49
Building 6	129
TOTALS	808

Table 8A.1 – Proposed Solar Arrays

Done in conjunction with roof replacement.

Energy Savings Methodology and Results

Savings are based on the difference in kWh price between the power purchasing agreement and the current electrical supplier.

Changes in Infrastructure

The proposed solar array would reside on the roofs of the buildings.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of utilities for brief tie-in periods.

Environmental Issues

Resource Use	None.
Waste Production	This measure will produce no waste by-products.
Environmental Regulations	Aside from the environmental benefits of increasing energy awareness no other environmental impact is expected.

ECM 9A Transformers

The key benefits of this ECM include:

- Energy Savings from reducing total energy consumption with more efficient, state of the art technology
- Equipment longevity due to more efficient and less wasteful equipment utilization

ECM Description	Building 1/2/3/5/6	Building 4
9A Transformers		✓

Existing Conditions

The transformers in locations within the electrical distribution systems in the School District consist of 480 Volts. Distribution transformers are installed in the Building 4 Electrical Room, Room 417 Closet and in the Auto Body room to step down the voltage to 120-208 Volts. Typically, an electrical distribution system has some losses associated with the electrical system and a considerable portion of these losses are associated with distribution transformers.





Systems Evaluation and Selection

Typical transformers are not designed to handle harmonic loads of today's modern facilities, and suffer significant losses as a result, even if the transformer is relatively new. Typically, conventional transformer losses, which are non-linear, increase by 2.7 times when feeding computer loads. The nonlinear load loss multiplier reflects this increase in heat loss, which decreases the net transformer efficiency. Also, unlike most substation transformers that are vented to the exterior, building transformers are ventilated within the building they are located, and their heat losses therefore add to the cooling load.

Based on site investigation conducted by our staff, we identified the following transformer that we propose to install an energy efficient replacement at a size matching the existing load as indicated in the table below:

Building	Location	kVA	Qty
Building 4	Electrical Room	500	1
Building 4	Room 417 Closet	30	1

Table 9A.1 – Existing Transformers to be Considered for Replacement

It was determined that the installation of the 75 and 112.5 kVA transformers in the Auto Body room would be cost effective at this time due to the narrow stairs leading to the transformer.

Proposed Solution

The proposed transformers will be Power Smiths High Efficiency K-Star Harmonic Mitigating unit. They are Energy-Star rated and meet the new TP1 Law requiring replacement of transformers of 600 volts or under.

Scope of Work

Remove and install new E-saver transformers

Per Transformer Unit:
1. Shut off the main electric power to the transformer to be replaced.
2. Disconnect the existing transformer and install replacement unit.
3. Turn power back on.
4. Inspect unit operation by performing electrical and harmonics testing.
5. Dispose of old transformers properly.

Energy Savings Methodology and Results

The energy savings for this ECM is realized by reduction in electric energy lost in the existing transformers as a result of the higher efficiency of the new transformers.

Changes in Infrastructure

New transformers where indicated.

Customer Support and Coordination with Utilities

Minor support will be required for the interruption of services for the affected areas.

Environmental Issues

Resource Use	Energy savings will result from increased voltage conversion efficiency.
Waste Production	Any removed parts will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

ECM 10A Energy Awareness & Education Program

The key benefits of this ECM include:

- Energy conservation by encouraging energy efficiency among teachers, students and staff
- Environmental education through instructional opportunities during and after the project

ECM Description	Building 1/2/3/5/6	Building 4
10A Energy Education	✓	✓

Proposed Programs

Studies show that significant energy savings can be achieved simply by increasing the energy awareness of building occupants. In order to accomplish this Honeywell proposes a multipronged educational and vocational learning approach, which will reduce energy consumption and enhance the educational experience for the faculty staff and students.

Energy Awareness Lobby Signage

Honeywell shall install a 42in. flat screen Energy Awareness Lobby Signage package in the lobby of the Morris County Vocational School District. The display will dynamically present to all students, staff and parents entering the school the actual results achieved by the District through its energy conservation and greenhouse gas reduction initiatives.



- Uses existing infrastructure Honeywell BMS and data already tracked by facilities
- Animation captures the audience; ideal for high traffic areas
- Information is customized and building specific
- Qualifies for points towards many energy program certifications

Additional Benefits to Morris County Vocation School District:

- Identifies your organization as forward thinking and environmentally aware
- Demonstrates how your organization is a good corporate citizen
- Stimulates building occupants to be more efficient in their own use of resources
- Builds community support

Student Vocational Training – Controls Lab Course

Honeywell shall provide the course materials and equipment necessary for the District to conduct a Controls Lab vocational learning opportunity. The course materials will teach students the fundamentals of building management system operation and control theory. Initially, students will work with a "Controls Lab" demonstration board, which will be equipped with direct digital controller, switches, dials, lights and fans used to simulate a real-world control system.



Controls Lab
Demonstration Board

By following a series of instructions laid out in a step-by-step learning module, the students will learn about different types of control signals, the basics of cause and effect program algorithms and basic proportional-integral-derivative (PID) control loop tuning. Additionally, if desired by the District, the students will be given the opportunity to log into the school's actual building management system in a secure "view-only" mode, allowing them to familiarize themselves with mechanical equipment functionality and control methodologies. Additional learning modules will guide

the students through the building management system and require them to collect system information further re-enforcing the purposes of individual pieces of mechanical equipment and the mechanical systems as a whole.

Green Boot Camp



Green Boot Camp is an intensive five-day, hands-on interactive educational experience to help educators become familiar with the latest methods of instruction to teach green and sustainable topics, methods, lessons and concepts to students at their respective schools.

Educators will discover, examine and identify the roots of green technology, sustainable living and environmental consciousness by using the buildings of the District as a hands-on working laboratory. Teachers will discover new concepts by using interactive exploratory projects such as designing and building a solar house, a wind turbine and more. Plus, they will master exciting new teaching technologies to deliver instruction to their students.

Energy Optimization Intern Program ("Project Tag Along")

The Energy Optimization Intern Program, also referred to as "Project Tag Along" is a Honeywell program which enables up to two junior or senior level students, who have an interest in engineering or environmental studies, the opportunity to safely participate in the development of the Energy Savings Plan for the Morris County Vocational School District. Typically, students will compete for the positions through an essay contest. The winning participants will accompany the Honeywell Engineering Team during the development of the plan. As a result of their successful participation, each student will receive a letter of recommendation from a Senior Honeywell Executive in recognition of their participation in our internship program.

Energy Savings Methodology and Results

Savings are based on increased energy awareness of building occupants.

Changes in Infrastructure

None.

Customer Support and Coordination with Utilities

None.

Environmental Issues

Resource Use	None.
Waste Production	This measure will produce no waste by-products.
Environmental Regulations	Aside from the environmental benefits of increasing energy awareness no other environmental impact is expected.

ECM 11A Water Conservation

The key benefits of this ECM include:

- Energy Savings from reducing energy loads
- Reduced Maintenance on plumbing fixtures
- Equipment longevity due to more efficient and less wasteful equipment utilization

ECM Description	Building 1/2/3/5/6	Building 4
11A Water Conservation	✓	✓

Existing Conditions

The use of water in schools has become more of a concern in recent years. Charges for potable water and sewage are now increasing at a rate greater than other utilities. Consequently, retrofits have been developed for different water fixtures found throughout the schools to reduce water consumption. The proposed new fixtures will provide savings without harming the functionality of the existing spaces. The enclosed design will standardize water systems utilized throughout the buildings while creating water cost savings for the School District.

Honeywell has investigated the water use at each of these facilities. The buildings utilize standard plumbing fixtures. The typical consumption for the kitchen sink aerators are 2.2 gallons per minute (gpm), typical bathroom sink aerators are 1.72 gpm, typical toilet fixtures are 2.88 gallons per flush (gpf), typical urinal fixtures are 1.38 gpf and typical pre-rinse sprayers are 2.64 gpm. New fixtures and aerators are available that use less water that can add up to water reduction over a long period.





Proposed Actions

Replace Water Closets

- Remove wall or floor mounted 2.88 gpf flush valve water closets and replace with 1.28 gpf flush valve water closets and all gravity type toilets with 1.0 pressure assisted water closets.
- Replace flush valve/component assembly on all water closets in this scope. Install new 1.28 gallons per flush valves
- Easy height, ADA fixtures shall be replaced like for like.
- Install water closets, level and stable, using shims if necessary.
- Install new flush valve and tube as level and straight as possible using existing conditions as acceptable goal.

Replace Urinals

- Remove existing1.38 gpf urinal and replace with 0.125 gpf urinal
- Replace flush valve/component assembly on all urinals in this scope
- Replace the angle stop, and flush tube when necessary up to 10% of total fixtures to ensure proper operation of the new fixture.

- Install new flush valve and tube as level and straight as possible using existing conditions as acceptable goal.

Retrofit Faucet Aerators

- Bathroom Aerators: Remove existing 1.72 gpm aerators from bathroom faucets and replace with 0.5 gpm flow rate aerators.
- Kitchen Aerators: Remove existing 2.18 gpm aerators from kitchen faucets and replace with 1.0 gpm flow rate aerators.

Retrofit Pre-Rinse Sprayers

- Replace existing 2.64 gpm pre-rinse sprayer with new 1.42 gpm pre-rinse sprayer.

Water Savings Methodology and Results

This project will reduce the quantity of water consumed by replacing the fixtures. Honeywell calculates water savings using the difference in measured baseline and post-installation flush volumes or flow rates for toilets, urinals, and faucets and the agreed upon number of uses per day. For each group of fixture type, the toilet and urinal consumption is measured in units of gallons per flush and faucets measured in gallons per minute creating a statistically valid sample of fixtures.

After implementation of this project, a statistically valid sample of each group of sanitary fixtures will be measured. All measurements will be a one-time measurement for the post-installation performance. Measurements will be done similar to those in the baseline measurements.

Frequency of Use	=	Number of users x % year-round occupancy x fixture uses/day/person
Water Savings (gal/yr)	=	*Frequency of Use x (Baseline – Estimated Flow Rate) (gpm or gpf per fixture) x days/year x % high-flow fixtures*
Sink Energy Savings (MMbtu/yr)	=	*Water Savings (gal/yr) x (Tmixed -Tcold) (°F) x (1 Btu/lb °F X 8.34 (lb/gal) x 1/boiler efficiency X 1 MMBtu/1,000,000Btu*
Cost Savings ($/yr)	=	*[Water Savings Toilets and Urinals + Water Savings Sinks] (kgal/yr) x [water rate + sewer rate] ($/kgal) + [(Sink Energy Savings (MMbtu/yr)] x Thermal Rate ($/MMbtu)]*

Changes in Infrastructure

New water fixtures and aerators will be installed as part of this measure

Customer Support and Coordination with Utilities

Minimal coordination efforts will be needed to reduce or limit impact to building occupants.

Environmental Issues

Resource Use	Water savings will result from lower water flows through new fixtures.
Waste Production	Old fixtures will be disposed of properly.
Environmental Regulations	No environmental impact is expected.

SECTION D TECHNICAL AND FINANCIAL SUMMARY

1. Recommended ESIP Project

	Recommended ESIP Project
Value of Project	$902,027
Term of Repayment	15 Years
Projected Savings Over Term	$1,219,348
Projected NJ Rebates & Incentives	$97,754
Projected Interest Rate	3.5%

Recommended Project Technical and Financial Summary Documents

Form II: Energy Conservation Measures (ECMs) Summary Form
Form III: Projected Annual Energy Savings Data Form
Form IV: Projected Annual Energy Savings Data Form in MMBTUs
Form V: ESCOs Proposed Final Project Cost Form
Form VI: ESCOs Preliminary Annual Cash Flow Analysis Form

Building by Building Simple Payback Summary

A simple payback summary broken down by building by ECM has been provided for the Morris County Vocational School District's use in reviewing available scope combinations and options.

Building By Building Simple Payback Summary (Hard Costs Only)

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Form II: Recommended Project - Energy Conservation Measures (ECMs) Summary Form

FORM II

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ENERGY CONSERVATION MEASUREs (ECMs) SUMMARY FORM
MORRIS COUNTY VO-TECH
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Honeywell International

Proposed Preliminary Energy Savings Plan: ECMs (Base Project)	Estimated Installed Hard Costs [1] $	Estimated Annual Savings $	Estimated Simple Payback (years)
1A LED Lighting	$ 436,461	$ 44,027	9.91
1B Destratification Fans	$ 48,215	$ 3,619	13.32
1C Vending Misers	$ 2,066	$ 235	8.78
3A Demand Control Ventilation	$ 35,266	$ 7,307	4.83
4A Building Envelope Improvements	$ 88,046	$ 13,632	6.46
4C Window Replacements	$ 57,042	$ 215	265.35
7A Permanent Load Reduction	$ -	$ -	-
9A Transformers	$ 41,327	$ 2,727	15.16
10A Energy Education	$ -	$ -	-
Design Allowance	$ 13,776	$ -	-
Add additional lines as needed* **Project Summary:**	$ 722,199	$ 71,762	10.06

Optional ECMs Considered, but not included with base project at this time	Estimated Installed Hard Costs [1] $	Estimated Annual Savings $	Estimated Simple Payback (years)
1D Lighting Controls	$ 11,767	$ 578	20.37
2A DHW Boiler Replacements	$ 41,327	$ 813	50.80
2B RTU Replacements	$ 490,415	$ 2,584	189.78
2C Kitchen Equipment Replacements	$ 82,654	$ 2,078	39.77
2D Kitchen Hood Controls	$ 135,002	$ 4,842	27.88
2E Walk In Compressor Controls	$ 6,612	$ 485	13.65
4B Roof Replacement	$ 199,641	$ 3,347	59.65
5A Computer Power Management	$ 7,714	$ 3,048	2.53
6A Cogeneration CHP	$ 241,075	$ 9,951	24.22
8A Solar PPA	$ 11,365	$ 35,513	0.32
11A Water Conservation	$ 168,092	$ 5,363	31.34
			-
			-
			-

Add additional lines as needed*

(1) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials & Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups,

Form III: Recommended Project - Projected Annual Energy Savings Data Form

FORM III

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP)
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM
MORRIS COUNTY VO-TECH
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

The projected annual savings for each fuel type MUST be completed using the following format. Data should be given in the form of fuel units that appear in the utility bills.

Energy/Water	ESCO Developed Baseline (Units)	ESCO Developed Baseline (Costs $)	Proposed Annual Savings (Units)	Proposed Annual Savings (Costs $)
Electric Demand (KW)	6,593	$43,697	1,264	$8,376
Electric Energy (KWH)	1,759,680	$216,350	320,083	$31,311
Natural Gas (therms)	134,036	$131,870	19,230	$18,928
Fuel Oil (Gal)	0	$0	0	$0
Steam (Pounds)				
Water (gallons)				
Other (Specify Units)				
Other (Specify Units)				
Avoided Emissions (1)	Provide in Pounds (Lbs)			
NOX	481			
SO2	707			
CO2	595,985			

(1) ESCOs are to use the rates provided as part of this RFP to calculate Avoided Emissions. Calculation for all project energy savings and greenhouse gas reductions will be conducted in accordance with adopted NJBPU protocols

(2) "ESCOs Developed Baseline": Board's current annual usages and costs as determined by the proposing ESCO; based off Board's utility information as provided to proposing ESCO.

(3) "Proposed Annual Savings": ESCOs proposed annual savings resulting from the Board's implementation of the proposed ESP, as based upon "ESCOs Developed Baseline".

Form IV: Recommended Project - Projected Annual Energy Savings Data Form in MMBTUs

FORM IV

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM IN MMBTUs
MORRIS COUNTY VO-TECH
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

The projected annual energy savings for each fuel type MUST be completed using the following format. Data should be given in equivalent MMBTUs.

ENERGY	ESCO Developed Baseline	ESCO Proposed Savings Annual	Comments
Electric Energy (MMBTUs)	6,004	1,092	
Natural Gas (MMBTUs)	13,404	1,923	
Fuel Oil (MMBTUs)	0	0	
Steam (MMBTUs)			
Other (Specify) (MMBTUs)			
Other (Specify)			

NOTE: MMBTU Defined: A standard unit of measurement used to denote both the amount of heat energy in fuels and the ability of appliances and air conditioning systems to produce heating or cooling.

Form V: Recommended Project ESCO's Proposal Project Cost Form

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCOs PROPOSED FINAL PROJECT COST FORM FOR RECOMENDED PROJECT
MORRIS COUNTY VO-TECH
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **HONEYWELL INTERNATIONAL**

PROPOSED CONSTRUCTION FEES

Fee Category	Fees [1] Dollar ($) Value	Percentage of Hard Costs
Estimated Value of Hard Costs [2]:	$722,199	
Project Service Fees		
Investment Grade Energy Audit	$7,944	1.10%
Design Engineering Fees	$36,110	5.00%
Construction Management & Project Administration	$28,888	4.00%
System Commissioning	$2,889	0.40%
Equipment Initial Training Fees	$2,889	0.40%
ESCO Overhead	$64,998	9.00%
ESCO Profit	$36,110	5.00%
Project Service Fees Sub Total	$78,720	10.90%
TOTAL FINANCED PROJECT COSTS:	$902,027	24.90%
ESCO Termination Fee (To be paid only if the Board decides not to proceed beyond the ESP)	$0.00	0.00%

PROPOSED ANNUAL SERVICE FEES

First Year Annual Service Fees	Fees [1] Dollar ($) Value	Percentage of Hard Costs
SAVINGS GUARANTEE (OPTION)	$0.00	0.00%
Measurement and Verification (Associated w/ Savings Guarantee Option)	$10,000.00	Flat Fee
ENERGY STAR™ Services (optional)	Included	0.00%
Post Construction Services (If applicable)	N/A	-
Performance Monitoring	Included	-
On-going Training Services	N/A	-
Verification Reports	Included	-
TOTAL FIRST YEAR ANNUAL SERVICES	$10,000.00	Flat Fee

NOTES:
(1) Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.
(2) The total value of Hard Costs is defined in accordance with standard AIA definitions that include:

Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead and Profit, etc.
ESCO's proposed interest rate at the time of submission: 5% TO BE USED BY ALL RESPONDING ESCOs FOR PROPOSAL PURPOSES
*Annual Service only applies if customer accepts energy guarantee.

Form VI: Recommended Project ESCO's Preliminary Annual Cash Flow Analysis Form

FORM VI
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Morris County Vo-Tech
ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: **Honeywell International**

Note: Proposers must use the following assumptions in all financial calculations:
(a) The cost of all types of energy should be assumed to inflate at: **2.4%** gas, **2.2%** electric per year and
(b) If it is necessary to inflate any other costs, these costs should also be assumed to inflate at: **2.4%** per year (this general inflation factor should NOT include increases in energy costs reflected above in (a), and should be noted if used in any calculation).

1. Term of Agreement: **15** (Years) (Months)
2. Construction Period [2] (months): **12**
3. Cash Flow Analysis Format:

Project Cost [1]: **$ 902,027** Interest Rate to Be Used for Proposal Purposes: **3.5%**

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/Incentives	Total Annual Savings [4]	Annual Project Costs	Board Costs	Annual Service Costs [3]	Net Cash-Flow to Client	Cumulative Cash Flow
Installation	$ 19,343			$ -	$ -	$ -	$ -	$ -	$ -
1	$ 58,615	$ 13,147	$ 28,322	$ 119,427	$ (115,727)	$ (125,727)	$ (10,000)	$ 3,700	$ 3,700
2	$ 59,942	$ 13,463	$ 44,750	$ 118,155	$ (114,455)	$ (114,455)	$ -	$ 3,700	$ 7,400
3	$ 61,300	$ 13,786	$ 21,561	$ 96,646	$ (92,946)	$ (92,946)	$ -	$ 3,700	$ 11,100
4	$ 62,688	$ 14,116	$ 1,561	$ 78,365	$ (74,665)	$ (74,665)	$ -	$ 3,700	$ 14,800
5	$ 64,108	$ 14,455	$ 1,561	$ 80,124	$ (76,424)	$ (76,424)	$ -	$ 3,700	$ 18,500
6	$ 65,560		$ -	$ 65,560	$ (61,860)	$ (61,860)	$ -	$ 3,700	$ 22,200
7	$ 67,045		$ -	$ 67,045	$ (63,345)	$ (63,345)	$ -	$ 3,700	$ 25,900
8	$ 68,564		$ -	$ 68,564	$ (64,864)	$ (64,864)	$ -	$ 3,700	$ 29,600
9	$ 70,117		$ -	$ 70,117	$ (66,417)	$ (66,417)	$ -	$ 3,700	$ 33,300
10	$ 71,705		$ -	$ 71,705	$ (68,005)	$ (68,005)	$ -	$ 3,700	$ 37,000
11	$ 73,329		$ -	$ 73,329	$ (69,629)	$ (69,629)	$ -	$ 3,700	$ 40,700
12	$ 74,991		$ -	$ 74,991	$ (71,291)	$ (71,291)	$ -	$ 3,700	$ 44,400
13	$ 76,690		$ -	$ 76,690	$ (72,990)	$ (72,990)	$ -	$ 3,700	$ 48,100
14	$ 78,427		$ -	$ 78,427	$ (74,727)	$ (74,727)	$ -	$ 3,700	$ 51,800
15	$ 80,204		$ -	$ 80,204	$ (76,640)	$ (76,640)	$ -	$ 3,564	$ 55,364
Totals	$ 1,052,628	$ 68,967	$ 97,754	$ 1,219,348	$ (1,163,984)	$ (1,173,984)	$ (10,000)	$ 55,364	$ 55,364

	3rd Incentive	$ 23,189
	Total Potential Cash Flow	$ 78,553

NOTES:
(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"
(2) No payments are made by Morris County Vo-Tech during the construction period.
(3) This figure should equal the value indicated on the ESCO's PROPOSED "FORM V". DO NOT include in the Financed Project Costs.
(4)First year Total Annual Savings includes installation energy savings.
***Annual Service only applies if customer accepts energy guarantee.**

HONEYWELL IS NOT ACTING AS A MUNICIPAL ADVISOR OR FIDUCIARY ON YOUR BEHALF. ANY MUNICIPAL SECURITIES OR FINANCIAL PRODUCTS INFORMATION PROVIDED IS FOR GENERAL INFORMATIONAL AND EDUCATIONAL PURPOSES ONLY AND YOU SHOULD OBTAIN THE ADVICE OF A LICENSED AND QUALIFIED FINANCIAL ADVISOR REGARDING SUCH INFORMATION.

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Building by Building Simple Payback Summary (Hard Costs Only)

Building & ECM	kWh Savings ($)	kW Savings ($)	Natural Gas Savings ($)	Water Savings ($)	Annual Energy and Operational Cost Savings ($)	Annual Operational Savings ($)	Net Cost ($)	Simple Payback
Building 1/2/3/5/6	**$ 20,252**	**$ 5,244**	**$ 13,654**	**$ -**	**$ 49,010**	**$ 9,860**	**$498,004**	**8.5**
1A LED Lighting	$ 16,899	$ 5,244	$ (1,136)	$ -	$ 30,868	$ 9,860	$305,823	7.5
1B Destratification Fans	$ (169)	$ -	$ 4,172	$ -	$ 4,003	$ -	$ 48,215	12.0
1C Vending Misers	$ 130	$ -	$ -	$ -	$ 130	$ -	$ 1,240	9.6
3A Demand Control Ventilation	$ 2,413	$ -	$ 3,209	$ -	$ 5,622	$ -	$ 13,500	2.4
4A Building Envelope Improvements	$ 912	$ -	$ 7,148	$ -	$ 8,061	$ -	$ 53,184	6.6
4C Window Replacements	$ 68	$ -	$ 260	$ -	$ 328	$ -	$ 76,042	232.0
7A Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
9A Transformers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
10A Energy Education	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Building 4	**$ 11,082**	**$ 3,132**	**$ 5,748**	**$ -**	**$ 23,249**	**$ 3,287**	**$229,419**	**8.6**
1A LED Lighting	$ 7,434	$ 2,890	$ (451)	$ -	$ 13,159	$ 3,287	$130,637	7.9
1B Destratification Fans	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
1C Vending Misers	$ 106	$ -	$ -	$ -	$ 106	$ -	$ 827	7.8
3A Demand Control Ventilation	$ 737	$ -	$ 949	$ -	$ 1,686	$ -	$ 21,766	12.9
4A Building Envelope Improvements	$ 322	$ -	$ 5,250	$ -	$ 5,572	$ -	$ 34,862	6.3
4C Window Replacements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
7A Permanent Load Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
9A Transformers	$ 2,485	$ 242	$ -	$ -	$ 2,727	$ -	$ 41,327	15.2
10A Energy Education	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
Project Total	$ 31,334	$ 8,376	$ 19,402	$ -	$ 72,259	$ 13,147	$727,423	8.5

2. Utility and Other Rebates and Incentives

NJ Pay-for-Performance Program (P4P)

Honeywell has been certified as a Pay for Performance Program Partner to provide technical services under direct contract to you. Acting as your energy expert, Honeywell will develop an Energy Reduction Plan for each project with a whole-building technical component of a traditional energy audit, a financial plan for funding the energy efficient measures and a construction schedule for installation. This supports your ability to take a comprehensive, whole-building approach to saving energy in your existing facilities and earn incentives that are directly linked to your savings.



Eligibility

Existing commercial, industrial and institutional buildings with a peak demand over 100 kW for any of the preceding twelve months are eligible to participate including hotels and casinos, large office buildings, multi-family buildings, supermarkets, manufacturing facilities, schools, shopping malls and restaurants. Buildings that fall into the following five customer classes are not required to meet the 100kW demand in order to participate in the Program: hospitals, public colleges and universities, nonprofits, affordable multifamily housing, and local governmental entities. Your Energy Reduction Plan must define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more to utilize the Pay Performance Program.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.



Incentives

Incentives for the P4P program are based on the annual electric and natural gas savings produced by the Energy Conservation Measures. There are three incentives to the program; details are included in the follow page. The first incentive is distributed after a finalized project is selected and bid. This usually occurs shortly before construction starts or shortly thereafter. The second incentive is distributed a few months after construction is completed, while the third incentive is distributed usually thirteen to fourteen months after the second incentive - once a year of building usage, post-retrofit, is completed.

Incentives, Rebates and Grants Summary

Honeywell has a great deal of experience in applying for, and successfully securing, all available incentives, rebates and grants for our clients. We have been approved for over $9M of incentives on behalf of our New Jersey customers alone since the introduction of the Energy Savings Improvement Program legislation in 2009. The New Jersey programs employed included primarily the Office of Clean Energy's Pay for Performance and Cogeneration Incentives.

Honeywell has determined that the Morris County Vocational School District is eligible for $97,754 in estimated total incentives for the projects. This includes $91,511 for the P4P program and $6,243 for Permanent Load Reduction Incentives.

Please refer to the tables below for a breakdown of Morris County Vocational School District incentive levels on a building by building basis for each type of incentive.

P4P Incentives

Building	P4P Incentives			
	First Incentive	Second Incentive	Third Incentive	Total Incentive
Building 1/2/3/5/6	$18,857	$30,672	$10,000	$59,529
Building 4	$9,465	$12,517	$10,000	$31,982
TOTALS	$28,322	$43,189	$20,000	$91,511

Permanent Load Reduction Incentives

Description	Permanent Load Reduction Incentives			
	1st Year Incentive	2nd Year Incentive	3rd Year Incentive	4th Year Incentive
Permanent Load Reduction Incentives	$1,561	$1,561	$1,561	$1,561

Total Rebates and Incentives

Year	P4P Incentives	Permanent Load Reduction Incentives	Total Incentives
Installation	$28,322		$28,322
Year 1	$43,189	$1,561	$44,750
Year 2	$20,000	$1,561	$21,561
Year 3		$1,561	$1,561
Year 4		$1,561	$1,561
TOTALS	$91,511	$6,243	$97,754

3. Financing the ESIP

In accordance with P.L.2012, c.55 an ESIP can be financed through energy savings obligations. The term refers to the two primary financing tools, debt and lease-purchase instruments. Each of these options is discussed below.

Energy savings obligations shall not be used to finance maintenance, guarantees, or the required third party verification of energy conservation measures guarantees. Energy saving obligations, however, may include the costs of an energy audit and the cost of verification of energy savings as part of adopting an energy savings plan or upon commissioning. While the audit and verification costs may be financed, they are not to be considered in the energy savings plan as a cost to be offset with savings.

In all cases, maturity schedules of lease-purchase agreements or energy savings obligations shall not exceed the estimated average useful life of the energy conservation measures.

An ESIP can also include installation of renewable energy facilities, such as solar panels. Under an energy savings plan, solar panels can be installed, and the reduced cost of energy reflected as savings.

The law also provides that the cost of energy saving obligations may be treated as an element of the local unit's utility budget, as it replaces energy costs.

Debt Issuance

The law specifically authorizes municipalities, school districts, cities, counties, and fire districts to issue refunding bonds as a general obligation, backed with full faith and credit of the local unit to finance the ESIP. Because an ESIP does not effectively authorize new costs or taxpayer obligations, the refunding bond is appropriate, as it does not affect debt limits, or in the case of a board of education, require voter approval. The routine procedures for refunding bonds found in the Local Bond Law and Public School Bond Law would be followed for issuance of debt, along with any required Bond Anticipation Notes as authorized pursuant to law.

Regarding bonds for public schools, the Department of Education (DOE) has concluded that debt financed ESIP projects are not covered by State aid for debt service or a "Section 15 EFFCA Grant" as there is no new local debt being authorized.

Tax-Exempt Lease Purchase Financing

The tax-exempt lease is a common form of financing ESIP projects. Tax-exempt leasing is a tool that meets the basic objectives of debt, spreading the cost of financing over the life of an asset, while avoiding constitutional or statutory limitations on issuing public debt. If structured properly, by including non-appropriation language in the financing documents, the tax-exempt lease will not be considered debt for state law purposes but will be considered debt for federal income tax purposes. Thus, for federal purposes, the interest component of the lease payment is tax-exempt.

Under the New Jersey Energy Savings Improvement Program (ESIP), the School District may authorize a lease purchase agreement between the School District and a financier. Ownership of the equipment or improved facilities will pass to the School District when all the lease payments have been made. There are legal expenses and other minimal closing costs associated with this type of structure. The lease purchase agreement may not exceed 15 years (commencing upon completion of the construction work), or 20 years where a combined heat and power or cogeneration plant is included in the project. This extended term will allow an improved cash flow over the term of the agreement or it will allow you to fund additional energy related opportunities. The primary benefits of a lease are lower rates and the acquisition of essential use property without creating debt.

Under a lease, there is typically a single investor. The lease may have non-appropriation language that allows the School District to access low tax exempt rates. Some previous customers have chosen to remove the non-appropriation language which has resulted in lower competitive rates.

Repayment of the lease payments is tailored to meet the requirements of the School District. Payments are typically scheduled to commence after the construction is complete and acceptance of the project has been received by the School District. Typically, payment terms are structured so there is no up-front capital expense to the School District and payments are aligned within your cash flow and fiscal limits.

Certificates of Participation (COPs)

Certificates of Participation are another form of a lease purchase agreement with the differentiating factor being that there are multiple investors participating in the purchase of the lease. COPs require financial disclosure and are typically utilized on higher value projects where one investor doesn't have the capacity to hold a high value lease for a single customer.

Energy Savings Obligations

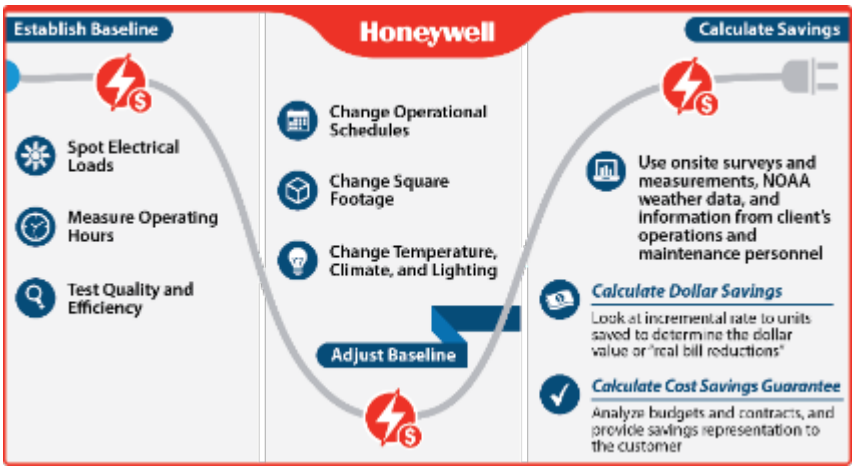
Energy Savings Obligations can be issued as refunding bonds in accordance with the requirements of N.J.S.A *40A:11-4.6(c)(3)*. These bonds may be funded through appropriation for the utility services in the annual budget of the contract unit and may be issued as refunding bonds pursuant to N.J.S.40A:2-52 et seq., including the issuance of bond anticipation notes as may be necessary, provided that all such bonds and notes mature within the periods authorized for such energy savings obligations. Energy savings obligations may be issued either through the contracting unit or another public agency authorized to undertake financing on behalf of the unit but does not require bond referendum.

SECTION E MEASUREMENT & VERIFICATION AND MAINTENANCE PLAN

1. Baseline

The purpose for establishing a baseline for an energy performance project is to accurately predict what the energy consumption and costs would have been as if the energy project was never completed. The baseline can then be used to measure the improvement in efficiency and determine the overall energy savings of the project. Since the energy consumption of all facilities is somewhat effected by variable weather conditions, a baseline for heating and cooling systems is typically dependent on degree-days or outside temperature. A baseline also needs to incorporate changes in facility use, such as a change in hours of operation or increased levels of outside air. Once again, if these changes would have occurred in the absence of the energy project, they should be incorporated into the project's baseline.

Honeywell will calculate the baseline based on the systems and operating conditions as they currently exist. Honeywell finds baseline development most accurate if specific measurements are taken on equipment over a period of time (early in the audit phase) to determine actual kW, kWh, oil and gas consumption, cfm, gpm, hours of use, etc. A summary of some of the methods, which will be used by Honeywell to establish baselines and support, calculated savings are listed below.



1. Spot measurements of electrical loads such as lighting, fan and pump motors, chillers, electric heat, etc.
2. Measurement of equipment operating hours using electric data recorders.
3. Measurement of existing operating conditions using data recorders for space temperature and humidity, air handler temperatures (mixed, return, cooling and heating coil discharges), and space occupancy using lighting loggers.
4. Spot measurement for boiler efficiencies, water use.
5. Running measurements of chiller operation, including simultaneous measurement of input kWh or steam flow, and chilled water supply and return temperatures and flow (gpm).
6. Records of operating conditions from building management systems and utility-grade meters.

The data from the above is used to calculate existing energy use, which is then reconciled with current facility utility bills, and adjusted as required to provide a mutually agreed baseline.

To provide valid savings evaluations, Honeywell's maintains a significant inventory of metering equipment utilized by its auditors and Energy Engineers to ascertain critical data about the operation of the facility.

Typically, Honeywell's auditors use the following equipment for their onsite measurements:

1. Recording and instantaneous power and harmonic analyzers.
2. Data loggers for pressures, temperatures, flow rates, humidity and CO_2.
3. Lighting level and recording profile/run-hour and occupancy meters.
4. Multimeters, hand held kW meters.
5. Combustion analyzers.
6. Ultrasonic flow meters.
7. Infrared thermometers

The ECMs installed in many projects allow for energy savings to be identified by direct metering or a combination of metering and calculations with accepted assumptions. In the case of lighting, for example, it is relatively easy to meter representative samples of unique fixture types, both before and after a retrofit, to determine the power consumption difference in Watts. When multiplied by the quantity of each fixture type, the total connected load reduction can be derived. In combination with run time assumptions, or meters, the electrical reduction can be accurately determined. Where possible, direct measurement of ECMs during construction

(before and after the retrofit) coupled with energy savings calculations is a method the Honeywell finds to be very accurate and cost-effective.

Due to the nature of some ECMs, or when a combination of ECMs is installed, individual (discrete) metering may not be either possible or able to fully document a baseline and calculate savings. Many of these situations can be handled by combining results from metering along with either engineering-based calculations or output from nationally recognized building simulation programs such as DOE II, ASEAM, TRACE or HAP. This method would be used for ECMs such as night setback, and where no other ECMs have significant interaction with the setback measure.

Formulas exercised in energy savings calculations follow the laws of physics, and many are included in the ASHRAE Handbook of Fundamentals. However, such calculations (i.e. equipment operation profiles) must be tempered by experience, past retrofit practice, and expectations of future operating conditions to arrive at achievable values in practice. Honeywell always reviews each and every project, in detail, for the anticipated savings and never hesitates to reduce the anticipated energy calculations where experience dictates necessary. The final result is a coupled project where the final savings are equal to or greater than anticipated.

Calculating the units of energy saved is a critical measure of energy efficiency improvements, but it does not indicate the actual dollars saved. To do this, Honeywell and Morris County Vocational School District will establish the base rates that will act as "floor" rates in calculating the savings. These are usually the rates that are in effect at the time of the start of the contract or rates used for audit estimated savings.

2. Adjustment to Baseline Methodology[1]

Honeywell's methodology for establishing and adjusting the baseline is determined by the characteristics of the facility, the conservation technology being installed, the technology being replaced, the type of measurement and verification Morris County Vocational School District requires and the needs of the District for future changes in facility use.
The purpose of this flexible approach is to make the most accurate possible measurement of the changes in energy uses that are specifically attributable to Honeywell installed ECMs. This creates the ability over the life of the contract to continue measuring only savings achieved by Honeywell and leaves Morris County Vocational School District free to make future changes to the building or systems without affecting the savings agreement. It also necessitates fewer provisions for making adjustments to the baseline.

Modifications to the energy baseline or savings will be made for any of the following:

1. Changes in the number of days in the annual review cycle.
2. Changes in the square footage of the facilities.
3. Changes in the operational schedules of the facilities.
4. Changes in facility indoor temperatures.
5. Significant changes in climate.
6. Significant changes in the amount of equipment or lighting utilized in the facility.

Examples of situations where the baseline needs to be adjusted are: i) changes in the amount of space being air conditioned, ii) changes in auxiliary systems (towers, pumps, etc.) and iii) changes in occupancy or schedule. If the baseline conditions for these factors are not well documented it becomes difficult, if not impossible, to properly adjust them when they change and require changes to payment calculations. To compensate for any addition and deletion of buildings and impact on the baseline model, Honeywell will use sound technical methodologies to adjust the baseline. An example would be to add or delete building energy impact via the calculated cooling load in tons as a percentage of the existing campus tonnage baseline or use indices like W/ft^2 and Btu/ft^2 to calculate the energy consumption of the building and then add or subtract the energy usage to or from the baseline energy consumption.

3. Energy Savings Calculations

In calculating energy savings, Honeywell's highly experienced audit staff uses onsite surveys and measurements, National Oceanic and Atmospheric Administration weather data, detailed discussions with the client's operations and maintenance personnel and engineers, utility records, and other sources to ensure accurate energy, water and O&M savings.

Typically, the following data is gathered:

[1] The energy baseline modifications shall use commonly accepted energy engineering methods that are mutually agreeable to both Honeywell and customer. Should agreement on these methods, including the climate adjustments, not be reached between Honeywell and customer, both parties could appeal to an independent engineering.

1. Local weather data.
2. Utility bills and sub-metered consumption trends.
3. Utility rate structure.
4. Facility use and occupancy data.
5. Internal equipment loads.
6. Interviews of operations and maintenance staff and management.
7. Building construction, age, use and layout.
8. Schematics of energy and water distribution systems.
9. Identification and inventory of HVAC equipment.
10. Identification and inventory of process equipment.
11. Design, configuration and operating characteristics of HVAC systems.
12. Design, configuration and operating characteristics of process systems.
13. Control strategies and sequences of operation for HVAC and other process equipment.
14. Identification and count of all lighting fixtures and determination of power consumption for each type.
15. Identification and inventory of lighting control methods.
16. Measurement of foot-candle levels at sample locations.
17. Power quality and harmonics, power factor.
18. Indoor air quality issues.

Calculating the units of energy saved is a critical measure of energy efficiency improvements, but it does not indicate the actual dollars saved. To do this, Honeywell and Morris County Vocational School District will establish the base rates that will act as "floor" rates in calculating the savings. These are usually the rates that are in effect at the time of the start of the contract or rates used for audit estimated savings.

The equation below will be used to calculate the annual savings in dollars.

$$AnnualSavings(\$) = \sum_{m=1}^{12} \{(Rate_{kWh,Base} \times kWh_{Saved,m}) + (Rate_{fuel\ Oil,Base} \times Fuel\ Oil_{Saved,gal,m}) + (Rate_{Steam,Base} \times Steam_{Saved,klbs,m}) + (Rate_{NG} \times NG_{Saved,MCF,m})\} + Agreed(\$)$$

where:

$Rate_{kWh,Base}$ = defined base rate for kWh consumption
$kWh_{Saved,m}$ = calculated kWh savings for month *m*

$Rate_{Fuel\ Oil,Base}$ = defined base rate for fuel Oil savings (XX/gal.)
$Fuel\ Oil_{Saved,m}$ = calculated chilled water savings in gal. for month *m*

$Rate_{Steam,Base}$ = defined base rate for steam consumption ($XX/MMBtu.)
$Steam_{Saved,m}$ = calculated Steam savings in MMBtu. for month *m*

$Rate_{NG,Base}$ = defined base rate for natural gas consumption ($XX/Therm)
$NG_{Saved,m}$ = calculated natural gas savings in Therms for month *m*

Agreed($) = Annual savings in dollars (water, sewer, maintenance, etc.)

Honeywell assigns dollar values to the true incremental value of savings for energy and water. In other words, we do not combine for example, demand and consumptions numbers so that there is an average value to savings. Honeywell looks at each incremental rate to units saved to properly determine the value (dollar) to Morris County Vocational School District or "real bill reductions". As noted in the RFP energy escalation rates will be established in accordance with New Jersey Board of Public Utility guidelines.

Based on this, Honeywell will review all utility bills (hourly data), tariffs, special contracts and commodity contracts to develop the incremental value (costs) of each utility.

The O&M savings is typically a function of existing Morris County Vocational School District budgets (labor & direct costs), maintenance contracts and operations (supplier) contracts. Honeywell will analyze the information to provide a conservative savings representation for Morris County Vocational School District review and acceptance. The information will include all calculations and assumptions.

4. Measurement & Verification

The purpose of performing any monitoring and verification is to establish an agreed upon process that provides the customer both a level of satisfaction that the improvements have been delivered and ongoing information as to their operation and performance. Additionally, this effort will be used to assess the actual dollars of savings versus the guarantee level.

It is essential for the success of this program that Honeywell and Morris County Vocational School District agree on a mutually acceptable methodology for measuring and verifying energy savings that are attributable to the energy conservation measures (ECMs) Honeywell installs. This M&V plan provides the procedures to document the energy and cost savings of each of the proposed ECMs.

The plan for monitoring and verifying energy savings for the proposed ECMs is based on the methods described in the *International Performance Measurement and Verification Protocol (IPMVP)*[2]. Our approach to M&V is directly consistent with, and in compliance with, the IPMVP. This protocol provides a framework for the most widely accepted and used M&V methods by the industry.

Engineering calculations of energy and cost savings for the project are based on operating parameters (such as weather, temperature settings, run hours, occupancy patterns, and space usage) and equipment performance characteristics. The M&V plan uses the operating parameters established in the baseline for all savings calculations during the term of the project. The intent of the M&V plan is to verify that the ECMs installed by Honeywell will provide the expected energy savings. Therefore, Honeywell will collect data and relative information during the post-retrofit period to demonstrate that the installed equipment is performing at expected levels. It is assumed that Morris County Vocational School District will continue to be a dynamic institution adding or renovating buildings and desiring to retain the right to set comfort and operating characteristics. To accommodate this, Honeywell will develop its M&V plan in a way that allows the District to adapt to the demands of future campus growth and changes without the need for Morris County Vocational School District and Honeywell to negotiate energy baseline adjustments.

Our typical M&V plan will utilize broadband Internet access to the appropriate Morris County Vocational School District control interfaces to both confirm operating status and to download trend data to verify proper equipment maintenance.

One year after the commencement date of the ECMs, Honeywell will submit a report verifying and calculating the energy and cost savings for the first year. This report will be submitted for facility review and approval. For the remaining contract term, Honeywell will provide annual reports. These reports will include results of inspections of the installed equipment/systems, energy and cost savings, and recommendations to provide optimum energy performance.

All permanent measurement equipment will be purchased new with a calibration certificate from the manufacturer. The power multi-meter and the TSI multi-meter will be calibrated annually before using them in the annual inspection.

General Approach to M&V

Energy and water savings are determined by comparing the energy and water use associated with a facility or certain systems within a facility before and after the installation of an ECM or other measure. The “before” case is the baseline. The “after” case is the post-installation or performance period. Baseline and post-installation energy use measurements or estimates can be constructed using the methods associated with M&V options A, B, C, and D, as described in the IPMVP. The challenge of M&V is to balance M&V costs, accuracy, and repeatability with the value of the ECM(s) or systems being evaluated, and to increase the potential for greater savings by careful monitoring and reporting

M&V Options

The IPMVP guidelines classify the M&V procedures into four categories, Options A, B, C and D. As shown in the table below, these options differ in their approach to the level of complexity of the M&V procedures.

M&V Option	Performance Verification Techniques
Option A Verifying that the measure has the potential to perform and to generate savings.	Option A is appropriate for ECMs that have energy use that can be readily quantified, such as the use of high efficiency lighting fixtures, high efficiency constant speed motors, and other standard engineering calculations. Engineering calculations before and after installation spot measurements and use of EMS data points with stipulated values.

[2] www.ipmvp.org.

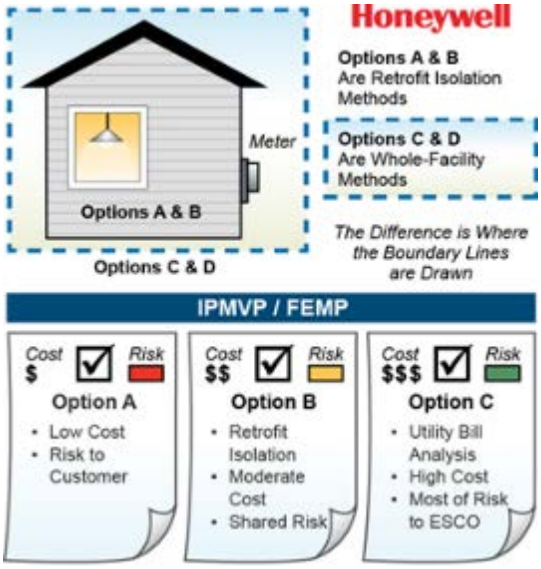
M&V Option	Performance Verification Techniques
Option B Verifying that the measure has the potential to perform and verifying actual performance by end use.	Option B is appropriate for ECMs that require periodic or on-going measurements to quantify energy use; such as the use of variable frequency drives on pump or fan motors. Engineering calculations with metering and monitoring strategy throughout term of the contract.
Option C Verifying that the measure has the potential to perform and verifying actual performance (whole building analysis.)	Option C is used for ECMs for which the energy use or energy savings cannot be measured directly, such as building envelope modifications. Option C is based on the use of utility meters to quantify building energy use. Utility meter billing analysis-using techniques from simple comparison to multivariable regression analysis.
Option D Verifying actual performance and savings through simulation of facility components and/or the whole facility	Option D is used for ECMs for which the energy use or energy savings cannot be measured directly, or savings for individual ECMs are heavily interdependent. Calibrated building simulation is used to separate the energy savings attributable to each ECM. Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering.

In general,

ECM Energy Savings = Baseline Energy Use - Post-Installation Energy Use

And
Energy Cost savings ($) = Total Energy Savings x Contractual Energy Rates

Exceptions to this simple equation are as follows:



Projects where an on/off M&V method is used. For example, after a new energy management system is installed, control features are turned off for a set period of time to recreate baseline conditions. Thus, savings are determined after installation by comparing energy use with and without the control features activated.

Since energy use at a facility is rarely, if ever, constant, another way to define M&V is as a comparison of a facility's post-installation energy use with its usage if the ECM or system had not been installed. This takes into account situations in which baseline energy use must be adjusted to account for changing conditions, such as changes in facility operation, occupancy, or use or external factors such as weather.

Post-Retrofit M&V Activities

There are two components associated with M&V of performance contract projects:

1. Verifying the potential of the ECM to generate savings also stated as confirming that the proper equipment/systems were installed, are performing to specification and have the potential to generate the predicted savings.
2. Determining/ verify energy savings achieved by the installed ECM(s).

Verifying the Potential to Generate Savings

Verifying baseline and post-installation conditions involves inspections (or observations), spot measurements, and/or commissioning activities. Commissioning includes the following activities:

- Documentation of ECM or system design assumptions
- Documentation of the ECM or system design intent for use by contractors, agencies and operators
- Functional performance testing and documentation necessary for evaluating the ECM or system for acceptance
- Adjusting the ECM or system to meet actual needs within the capability of the system

Post-Installation Verification

Post-installation M&V verification will be conducted by both Honeywell and the Client to ensure that the proper equipment/systems that were installed are operating correctly and have the potential to generate the predicted savings. Verification methods may include surveys, inspections, and/or spot or short-term metering.

Regular Interval Post-Installation Verification

At least annually, Honeywell will verify that the installed equipment/systems have been properly maintained, continue to operate correctly, and continue to have the potential to generate the predicted savings. Savings report for all the installed ECMs will be submitted each year after the acceptance date of the work performed by Honeywell.

Computation of Energy Savings

After the ECMs are installed, energy and cost savings will be determined annually by Honeywell in accordance with an agreed-upon M&V approach, as defined in a project-specific M&V plan.

Construction/Interim Savings

Construction or Interim savings are usually measured by using the same methodology as described in the detail M&V plan for each ECM. The start and the completion time for each ECM must be agreed to between Honeywell and Morris County Vocational School District.

Electricity and thermal savings from the ECMs where no detailed long-term data is required to be collected will be stipulated and will be based on the starting and the final completion dates and verification of the operation of the ECMs. For other ECMs where long-term data collection is required by the M&V plan, data will be used to calculate the savings using the same equations as described in the detail plan. For example, to calculate electricity savings for the installation of a VFD, the kW is spot measured at a set speed for selected motors through a sampling plan. The measured kW is subtracted from the baseline kW to calculating the savings. Thermal savings are tied to the electrical savings in the manner described in the detail M&V plan. The results are extrapolated to cover all the VFDs installed by Honeywell.

The savings for each of the monitored VFD is calculated on an interval basis as follows:

$kW_{Saved} = (kW_{Base} – kW_{Spot\ Measured})$

kWh_{Saved} = Estimated operating hours during the interim period * kW_{Saved}

The total kWh savings is the sum of the kWh_{Saved} for all the installed VFDs.

5. Site Specific M&V Plan

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
ECM 1A – LED Lighting	Upgrade lighting systems: Re-lamp/Re-ballast T-8 to LED New Fixtures Incandescent to LED High Pressure Sodium and Metal Halide to LED	Option A: Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of kW for 5% sample fixtures in each category Data log usage hours Data log occupancy schedules Update Line by Line scope with measured kW and usage hours Post M&V: Measurement of KW for 5% sample fixtures in each category Usage hours to remain same Occupancy schedules to remain same Energy Savings: Update Line by Line scope with measured kW and usage hours and compare to pre-retrofit calculated savings
ECM 1B – De-Stratification Fans	Install destratification fans in Fitness Center and Gymnasium to minimize stratification of hot air and maintain hot airflow below the fan level	Option A: Pre and Post measurements and engineering calculations	Pre M&V: Verify existing operating parameters match the baseline calculation assumptions Post M&V: Verify that systems are installed as specified and controls are programmed to match the savings assumptions Energy: Verify savings based on programmed parameters and engineering calculations
ECM 1C – Vending Misers	Install vending machine energy management devices	Option A: Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of kW for 5% sample machines in each category Data log usage hours Data log occupancy schedules Update Line by Line scope with measured kW and usage hours Post M&V: Measurement of KW for 5% sample machines in each category Usage hours to remain same Energy Savings scope with measured kW and usage hours and compare to pre-retrofit calculated savings
ECM 1D – Lighting Controls	Upgrade lighting systems: Install lighting controls.	Option A: Pre and Post measurements Line by Line scope and engineering calculations	Pre M&V: Measurement of kW for 5% sample fixtures in each category Data log usage hours Data log occupancy schedules Update Line by Line scope with measured kW and usage hours Post M&V: Measurement of KW for 5% sample fixtures in each category Usage hours and occupancy schedules to change

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
			Energy Savings: Update Line by Line scope with measured kW and usage hours and compare to pre-retrofit calculated savings
ECM 2A – Domestic Hot Water Boiler Replacements	Replace existing domestic hot water heaters with condensing natural gas domestic hot water heaters	Option C: Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform combustion efficiency test on domestic hot water heaters Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Perform efficiency test on replaced domestic hot water heaters to ensure operating conditions are maintained
ECM 2B – RTU Replacements	Replace antiquated rooftop units with new high efficiency equipment	Option A (Electric): Engineering calculations based on pre and post kW measurements Option C (Thermal): Utility Bill Comparison for all fuel related measures	Pre M&V: Verify manufacturer provided data for existing unit efficiency (SEER) Post M&V: Verify manufacturer provided data for new rooftop unit (SEER). Compare post installation – M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Verify the new equipment and controls are installed and commissioned as recommended by manufacturer
ECM 2C – Kitchen Equipment Replacements	Convert kitchen appliances from electric to natural gas.	Option A (Electric): Engineering calculations based on pre and post equipment data. Option C (Thermal): Utility bill comparison for all fuel related measures	Pre M&V: Verify capacity of existing equipment Post M&V: Ensure all equipment is installed and working properly
ECM 2D - Kitchen Hood Controls	Install control devices on the kitchen hoods to control exhaust air in response to the cooking load. Replace fan motors with new premium efficiency motors and VFD drives	Option A: Engineering calculations for variable frequency drives following affinity laws. Engineering calculations based on nameplate, manufacturer supplied data and operating hours for the existing and replacement motors	Pre M&V: Verify manufacturer provided data for the motor performance data and motor efficiencies Post M&V: Obtain trend data for VFD operation to verify baseline calculation assumptions on system loads. Verify efficiency of new motors
ECM 2E – Walk-In Compressor Controls	Install control device on walk-in freezer and refrigerator evaporators to shut down the fan motor when the compressor is off on duty cycle	Option A: Stipulated engineering calculations based on case studies for the Intellidyne control	Pre M&V: None Post M&V: Savings stipulated based on engineering calculations for the term of contract
ECM 3A – Demand Control Ventilation	Install CO2 sensor controls to limit OA based on occupancy of space..	Option A: Energy savings - Engineering calculations based on programmed parameters.	Pre M&V: Verify existing operating parameters match the baseline calculation assumptions Post M&V:

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
			Verify that systems are installed as specified and controls are programmed to match the savings assumptions Energy: Verify savings based on programmed parameters and engineering calculations
ECM 4A - Building Envelope Improvements	Install weather stripping on doors, seal roof wall joints and building penetrations	Option A: Energy savings - Engineering calculations based on programmed parameters.	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V: Verify that systems are installed as specified to match the savings assumptions Energy: Verify savings based on programmed parameters and engineering calculations
ECM 4B – Roof Replacement	Furnish and install a new roofing system	Option A: Electric energy savings - Engineering calculations based on programmed parameters. Option C: Fuel Savings - Utility Bill Comparison for all fuel related measures	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V: Fuel: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days
ECM 4C – Window Replacements	Replacement of windows with double-pane, low-e, metal frame windows	Option A: Electric energy savings - Engineering calculations based on programmed parameters.	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V Verify that systems are installed as specified to match the savings assumptions Energy: Verify savings based on programmed parameters and engineering calculations
ECM 5A – Computer Power Management	Provide program to shut down computers when building is not occupied	Option A: Stipulated Engineering calculations based on computer power management software information.	Pre M&V: None Post M&V: Savings stipulated based on engineering calculations for the term of contract
ECM 6A – Cogeneration - Combined Heat & Power (CHP)	Install Cogeneration unit	Option A Engineering calculations based on nameplate and manufacturer supplied data for the cogeneration units and - engineering calculations based on programmed parameters. Option C Utility Bill Comparison for all fuel related measures	Pre M&V: Baseline annual fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days Verify parameters used in engineering calculations with site conditions Post M&V: Compare post installation M&V fuel cost based on fuel billing data and Metrix tuned to normalize to heating degree days

ECM # and Name	Summary of ECM	Measurement and Verification Methodology / Recommendation	Description of M&V – Pre and Post Process
ECM 7A - Permanent Load Reduction	Participate in PJM permanent load reduction program	N/A	Pre M&V: N/A Post M&V: N/A
ECM 8A – Solar PPA	Install roof-mounted solar PV arrays	N/A	Pre M&V: Utilize baseline kWh consumption determine kWh produced Post M&V: Measure and provide a report of the kWh generated
ECM 9A – Transformers	Replace existing secondary transformer with high efficiency equivalent	Option A: Engineering calculations based on increase in transformer efficiency	Pre M&V: Measure typical existing transformer (typical one for each size) input and output KW to establish transformer losses Post M&V: Measure input and output KW for new transformer (typical one for each size) Verify savings with engineering calculations
ECM 10A – Energy Education	Implement Energy Education Program for students and staff	N/A	Pre M&V: N/A Post M&V: N/A
ECM 11A – Water Conservation	Install low flow devices for water savings.	Option C (Fuel and Water)- Savings calculations are based on regression analysis of utility billing meter data.	Pre M&V: Verify parameters used in engineering calculations with site conditions Post M&V Fuel/Water: Compare post installation M&V utility cost based on utility billing data and Metrix tuned to normalize the data

6. Guarantee of Savings

The approach that Honeywell utilizes in this asset management program includes two key components: a *performance guarantee* and *financial savings*. Honeywell guarantees the District that all installations and work performed are subject to final inspection and the District's acceptance. This procedure ensures all work will be to the level of quality the District expects.

Honeywell also guarantees it will meet the objectives mutually defined with the District. Honeywell takes its commitment to partner with Morris County Vocational School District for the life of the contract seriously, and looks forward to a successful, long-term partnership.

Honeywell considers the guarantee to be the cornerstone of our service to you. To be considered a *performance contract* an energy guarantee is an optional component under the New Jersey Energy Savings Improvement Program (ESIP) legislation. The basis of an energy performance contract is that the majority of risk is shifted from the District to the ESCO. The strength of the Guarantee is only as good as the Company backing it and their financial solvency. With over $39.3 Billion in assets, Honeywell has the financial strength and background to support the District for the long term.

Savings Guarantee: With the understanding that Morris County Vocational School District must maintain fiscal health and accountability, Honeywell can financially guarantee the results of its programs and clearly support this obligation with the commitment to regular review of program results and reconciliation. Honeywell's financial strength and stability give it the ability to extend a FIRST-PARTY GUARANTEE to Morris County Vocational School District. A first party guarantee eliminates the risk on the District and places it directly onto Honeywell. This differs from some other ESCO's who provide a third-party guarantee, which insulates them from the owner through the use of insurance instruments.

If at the end of any year the program has not met or exceeded the guaranteed savings for that year, Honeywell will refund the difference between the guaranteed amount and what was actually saved.

For all equipment covered by the Energy Savings Guarantee, Morris County Vocational School District shall be responsible for on-going maintenance and component replacement in accordance with manufacturer's standards. The customer will also be responsible for operating the equipment in accordance with manufacturer's specifications.

Honeywell will develop savings methodologies that follow current industry practice, such as outlined by the New Jersey Board of Public Utilities (BPU) and Federal Energy Management Program's (FEMP) M&V Guidelines: Measurement and Verification for Federal Energy Projects. References to M&V protocols from the International Performance Measurement and Verification Protocol (IPMVP), ASHRAE Guideline 14 and the Air-Conditioning Refrigeration Institute (ARI) are used to further qualify the M&V plan.

As stated above, under the New Jersey ESIP legislation acceptance of a performance guarantee is optional at Morris County Vocational School District sole discretion. In the same way, the duration of the guarantee is also optional. Many of Honeywell's New Jersey customers have elected to keep the guarantee in force for less than the total performance periods, i.e. three (3) to five (5) years. Others have elected to accept a one (1) year guarantee, while reserving the option to renew for additional years after they have had the opportunity to review the track record of actual savings results. Obviously, this a very customer specific decision based on the risk management culture of each unique organization. The key point is that Honeywell is flexible with regard to the structure and duration of the guarantee. The final terms will be discussed and defined as part of our co-authored ESIP project.

Solely for informational purposes, it is worth noting that if the District does elect to accept a guarantee, New Jersey ESIP law requires that the District contract with a third-party independent firm to verify that the energy savings are realized. In order to preserve the independent status of this contractor these costs are required to be incurred directly by the District.

The RFP requires that the cost of the guarantee be identified during this response phase. Honeywell develops and implements every project with the same high level of detail and confidence and therefore will always provide a Savings Guarantee at no additional cost. However, if the District opts to accept the Savings Guarantee, the fee indicated on Form V in Section H-1 will be applicable to account for on-going Honeywell service costs incurred during the measurement and verification of the savings.

All guarantees require that the owner maintain the system in accordance with the manufacturer's specifications. Regardless of guarantee acceptance, ongoing maintenance as recommended by the BPU, Honeywell and / or manufacturer specifications is

required to achieve the projected energy savings. Maintenance should also include a periodic verification of the system to make sure the maintenance is properly conducted and the system is meeting the original specifications and design.

7. Recommended Preventive Maintenance Services



A Comprehensive Portfolio, a Customized Approach.

Honeywell offers a uniquely comprehensive portfolio of services – one of the most extensive in the industry. As part of the Energy Savings Plan, we recommend the following services for consideration to ensure achievement of the Energy Savings outlined in this plan

Per the NJ ESIP program, all services are required to be bid by the Morris County Vocational School District for services as desired. Based on Honeywell's vast service organization, we are uniquely qualified to develop design specification for the public bidding per NJ Law.

Honeywell strongly believes that the long-term success of any conservation program is equally dependent upon the appropriate application of energy savings technologies, as well as solid fundamental maintenance and support. One of the primary contributors to energy waste and premature physical plant deterioration is the lack of operations, personnel training and equipment maintenance.

Honeywell recommends routine maintenance on the following systems throughout the Morris County Vocational School District for the duration of an energy guarantee of savings

Maintenance, Repair and Retrofit Services:

- Mechanical Systems
- Building Automation Systems
- Temperature Control Systems
- Air Filtration

Honeywell will work with the Morris County Vocational School District to evaluate current maintenance practices and procedures. This information will be the basis of a preventive maintenance and performance management plan designed to maximize building operating efficiencies, extend the useful life of your equipment and support the designed Energy Savings Plan.

At a minimum, we recommend the following tasks be performed on a quarterly basis with the Morris County Vocational School District's Building Management System.

System Support Services

1. Review recent mechanical system operation and issues with customer primary contact, on a monthly basis.
2. Review online automation system operation and event history logs and provide summary status to the customer primary contact. Identify systemic or commonly re-occurring events.
3. Check with customer primary contact and logbook to verify that all software programs are operating correctly.
4. Identify issues and prioritize maintenance requests as required.
5. Provide technical support services for trouble shooting and problem solving as required during scheduled visits.
6. Provide ongoing system review and operations training support; including two semi-annual lunches and learn sessions.
7. Establish dedicated, site-specific emergency stock of spare parts to ensure prompt replacement of critical components. These will be stored in a secure location with controlled access.

Configuration Management

1. Update documentation and software archives with any minor changes to software made during maintenance work.
2. Verify and record operating systems and databases.
3. Record system software revisions and update levels.

4. Archive software in designated offsite Honeywell storage facility, on an annual basis.
5. Provide offline software imaging for disaster recovery procedures, updated on a regular basis.

Front End / PC Service

1. Verify operation of personal computer and software:
2. Check for PC errors on boot up
3. Check for Windows errors on boot up
4. Check for software operations and performance, responsiveness of system, speed of software
5. Routinely backup system files, on an annual basis:
6. Trend data, alarm information and operator activity data
7. Custom graphics and other information
8. Ensure disaster recovery procedures are updated with current files
9. Clean drives and PC housing, on an annual basis:
10. Open PC and remove dust and dirt from fans and surfaces
11. Open PC interface assemblies and remove dust and dirt
12. Clean and verify operation of monitors.
13. Verify printer operation, check ribbon or ink.
14. Initiate and check log printing functions.
15. Verify modem operation (if applicable).
16. Review IVR schedule for alarms and review (if applicable).

Temperature Controls

UNIT VENTS

Services Performed

Annual Inspection

1. Inspect motor and lubricate.
2. Lubricate fan bearings.
3. Inspect coil(s) for leaks.
4. Vacuum interior.
5. Test operation of unit controls.

PUMPS

Services Performed

Preseason Inspection

1. Tighten loose nuts and bolts.
2. Check motor mounts and vibration pads.
3. Inspect electrical connections and contactors.

Seasonal Start-up

1. Lubricate pump and motor bearings per manufacturer's recommendations.
2. Visually check pump alignment and coupling.
3. Check motor operating conditions.
4. Inspect mechanical seals or pump packing.
5. Check hand valves.

Mid-season Inspection

1. Lubricate pump and motor bearings as required.
2. Inspect mechanical seals or pump packing.
3. Ascertain proper functioning.

Seasonal Shut-down

1. Switch off pump.
2. Verify position of hand valves.
3. Note repairs required during shut-down.

PACKAGED AIR-CONDITIONING SYSTEMS

Services Performed

Preseason Inspection

1. Energize crankcase heater.
2. Lubricate fan and motor bearings per manufacturer's recommendations.
3. Check belts and sheaves. Adjust as required.
4. Lubricate and adjust dampers and linkages.
5. Check condensate pan.

Seasonal Start-up

1. Check crankcase heater operation.
2. Check compressor oil level.
3. Inspect electrical connections, contactors, relays, operating and safety controls.
4. Start compressor and check operating conditions. Adjust as required.
5. Check refrigerant charge.
6. Check motor operating conditions.
7. Inspect and calibrate temperature, safety and operational controls, as required.
8. Secure unit panels.
9. Pressure wash all evaporator and condenser coils (if applicable)
10. Log all operating data.

Mid-season Inspection

1. Lubricate fan and motor bearings per manufacturer's recommendations.
2. Check belts and sheaves. Adjust as required.
3. Check condensate pan and drain.
4. Check operating conditions. Adjust as required.
5. Log all operating data.

Seasonal Shut-down *

1. Shut down per manufacturer's recommendations.

* If no Shut-down is required then (2) Mid-season Inspections are performed

BOILERS

Services Performed

Preseason Inspection

1. Inspect fireside of boiler and record condition.
2. Brush and vacuum soot and dirt from flues (not chimneys) and combustion chamber.
3. Inspect firebrick and refractory for defects.
4. Visually inspect boiler pressure vessel for possible leaks and record condition.
5. Disassemble, inspect and clean low-water cutoff.
6. Check hand valves and automatic feed equipment. Repack and adjust as required.
7. Inspect, clean and lubricate the burner and combustion control equipment.
8. Reassemble boiler.
9. Check burner sequence of operation and combustion air equipment.
10. Check fuel piping for leaks and proper support.
11. Review manufacturer's recommendations for boiler and burner start-up.
12. Check fuel supply.
13. Check auxiliary equipment operation.

Seasonal Start-up

1. Inspect burner, boiler and controls prior to start-up.
2. Start burner and check operating controls.
3. Test safety controls and pressure relief valve.
4. Perform combustion analysis.

5. Make required control adjustments.
6. Log all operating conditions.
7. Review operating procedures and owner's log with boiler operator.

Mid-season Inspection

1. Review operator's log.
2. Check system operation.
3. Perform combustion analysis.
4. Make required control adjustments.
5. Log all operating conditions.
6. Review operating procedures and log with boiler operator.

Seasonal Shut-down

1. Review operator's log.
2. Note repairs required.

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SECTION F DESIGN APPROACH

In accordance with the ESIP PL 2012, c.55 as part of the implementation process, an agreement between the Morris County Vocational School District and Honeywell will determine the energy conservation measures (ECM's) to be implemented. The services of a NJ Licensed Engineering firm and / or Architectural firm shall then be secured to properly comply with local building codes, compliance issues and NJ Public contracts law. Specifications will be designed and developed to exact standards as recommended by Honeywell to achieve all savings outlined in this Energy Savings Plan (ESP). Once specifications are completed, Honeywell will publicly solicit contractors capable of meeting the requirements of the specification for each trade. However, even before the completion of the bidding process, Honeywell project management will be engaged to maintain the overall project schedule and ensure the East Brunswick Public School's expectations are met. An overview of these activities and functions are detailed below.

1. Safety Management Plan

All of Honeywell's Project Management Plans begin with safety. By integrating health, safety and environmental considerations into all aspects of our business, we protect our customers, our people and the environment, achieve sustainable growth and accelerated productivity, drive compliance with all applicable regulations and develop the technologies that expand the sustainable capacity of our world. Our health, safety and environment management systems reflect our values and help us meet our customer's needs and our business objectives.

Honeywell's Safety Management Plan is provided in Appendix 5.

2. Project Management Process

Honeywell approaches any ESIP project with a systematic, tested and proven delivery process based upon industry best practices including strong project management, open and collaborative communication, superior technical design and state of the art technologies. We go above and beyond, with multiple NJ delivery teams to ensure sufficient resources, meticulous and thorough training and commissioning, and robust maintenance planning that goes the extra mile for the long term. Honeywell excels at project delivery because of our experience in New Jersey delivering ESIP projects with results that meet or exceed expectations.



Honeywell will demonstrate our partnership-based commitment to The Morris County Vocational School District throughout the development and delivery of your ESIP project, as we have done for dozens of other public entities throughout New Jersey under the ESIP Law. Our approach is backed by our references and track record and highly experienced engineering resources, which will be fully utilized to help you achieve your unique project goals and requirements.
Honeywell prescribes four phases in the ESIP Process that constitutes your project, including:

- Phase 1: Investment Grade Energy Audit (IGEA)
- Phase 2: Project Implementation
- Phase 3: Commissioning and Training
- Phase 4: Energy Savings Guarantee Period

The IGEA will commence with a kickoff meeting between key project stakeholders of the Morris County Vocational School District and Honeywell to review the ESIP Process, including the expectations of both parties during the IGEA, audit parameters, reporting

methods, building access protocols, availability of utility and building data, et cetera. Phase 2 will commence after our kickoff meeting has concluded with agreed upon next steps.

Honeywell takes a holistic approach in development of a comprehensive solution that is customized to meet your operational and facility needs and project goals. Our integrated project delivery approach supports continuous and collaborative communication between key stakeholders throughout the process. Our IGEA development process includes the following steps:

- Step 1: Discovery
  - Ascertain your goals and expectations to define project requirements
  - Involve key decision makers to prioritize
  - Aggregate utility and building data to benchmark energy consumption
  - Ensure site access for energy audits and site measurements to complete survey work
  - Inventory equipment

- Step 2: Identify and Develop Project
  - Complete ECM list focused on your requirements
  - Coordinated development effort to refine project scope
  - Conceptual scopes of work to further define
  - Determine modeling approach and M&V methodology

- Step 3: Cost and Savings Forecasting
  - Calculate energy and cost savings
  - Identify utility rebates
  - Detailed scopes of work
  - Operating strategies and equipment performance data

- Step 4: Deliver Solution
  - Deliver final IGEA report and contract
  - Finalize scope of work
  - Secure financing
  - Deliver positive cash flow
  - Finalize savings guarantee
  - Commissioning, M&V and training program

Step 1: Discovery

The first step of your IGEA is to gain a thorough comprehension of the East Brunswick Public School's key priorities and requirements. Honeywell will work with you to identify what your key needs and goals include and investigate your buildings and systems with that in mind during this step.

Honeywell will initiate your IGEA shortly after formal selection with a kickoff meeting involving all key project decision makers of the Morris County Vocational School District and Honeywell. The purpose of this meeting is to establish preliminary project expectations and define key next steps of the process to inform the IGEA.

Honeywell will develop a customized plan for developing an efficient, cost effective and solutions based project including schedule, finance, performance requirements and scheduling activities.

Honeywell will schedule site visits to commence at the earliest convenience. Utility data is a key component used for establishing your energy baseline to project potential energy savings. Building plans and operating schedules will assist Honeywell to focus our time during the site visits and serve to provide the means for our engineers to complete their calculations. Data required for this step includes 24 months of electric, thermal, water/sewer data, original and renovation drawings, equipment lists, equipment operating schedules, occupancy data and maintenance records and repair costs.

Our goal for the site surveys is to understand your systems in each facility and to identify potential energy conservation measures (ECMs) for inclusion in your final project scope. This step allows Honeywell to determine needed improvements by evaluating each

building and its systems in terms of condition, performance and age, including lighting and HVAC systems, Building Automation Systems, building envelopes, electrical distribution, domestic water and heating systems, et cetera.

Step 2: Identify and Develop Project

Honeywell will take the findings of our earlier diagnostic phase to develop solutions that address your priorities and key needs as ascertained in Step 1. Our collaborative, solutions based approach will allow you to maximize savings so as to invest more into modernizing buildings and generate maximum rebates to help deliver the most positive cash flow available.

Our primary objective is to ensure quality control and on time delivery throughout your project. Your project will have a dedicated team consisting of project management and engineering who have helped deliver similarly sized project under ESIP in recent past.

Honeywell will create an exhaustive ECM list following the completion of the site survey process. Each opportunity is then analyzed individually to determine both economic and construction feasibility. Input from the Morris County Vocational School District is critical to determine how each ECM fits within your overall project priorities. Honeywell's ECM Opportunity Funnel will help further narrow down the list of potential ECMs to your final ESIP project scope, by analyzing all aspects of your energy consumption to deliver an optimal project scope based on realistic savings potential. Our unique collaborative approach ensures that we deliver on your expectations while providing for turnkey solutions that are cost effective.



Step 3: Cost and Savings Forecasting

Honeywell will then move on to analyze and quantify your unique savings guarantee utilizing the East Brunswick Public School's dedicated ESIP Team. During this step we will quantify energy savings by identifying the scope of work and its impact on your facilities and systems. We will measure individual ECMs based on how they will impact future performance of the building as a whole. This will help to ensure that the ECM savings are accounted for only once. Results are then subject to peer reviews to verify accurate modeling and savings forecasts based on the proposed scope of work.

Honeywell's unique approach to engineering is why we often exceed the savings guarantee of our contracts.

Step 4: Deliver Solution

Honeywell will leverage our experience delivering more than two dozen NJ ESIP projects since 2009 to help the Morris County Vocational School District complete a successful project on time that maximizes realistic savings, cash rebates and positive cash flow. We have learned through this unrivaled experience that what matters most is to meet your expectations and ensure your involvement in the decision making process. REACT (Rebate Energy Analysis Constructability Tool) will provide for an interactive solution development experience designed to maximize New Jersey Office of Clean Energy rebates. Our No Change Orders policy (which helps distinguish Honeywell from the competition) will further reduce risk and enhance project results. And our in-house finance team (Honeywell Global Finance) will work to ensure that you secure the most competitive financial offering and interest rate available. No ESCO offers more value throughout the ESIP Process than Honeywell.

Our deliverables during this final phase will include:

- Final IGEA Report
- Project Schedule
- Construction Plan
- Commissioning Plan
- M&V Plan
- Training Plan
- Energy Services Contract

A. Honeywell Performance Contracting

Honeywell is the undisputed performance contracting market leader in the Northeast. Honeywell's Guaranteed Performance Contracting, which we pioneered in the early 1980's, has surpassed the $2 billion mark in cumulative sales. Our performance contracting business features specialized and dedicated resources, including people with expertise specifically to address the needs of our customers. Our portfolio of business experience in the region is over 400 projects and over $500 million in project investment.

B. Project Management Policy: Honeywell's Commitment to Health, Safety and the Environment

All of Honeywell's Project Management Plans begin with safety. By integrating health, safety and environmental considerations into all aspects of our business, we protect our customers, our people and the environment, achieve sustainable growth and accelerated productivity, drive compliance with all applicable regulations and develop the technologies that expand the sustainable capacity of our world. Our health, safety and environment management systems reflect our values and help us meet our customer's needs and our business objectives.

Our Safety Commitment to the Morris County Vocational School District

In today's world, nothing is more important than safeguarding our families at home, at work and at school. Through Honeywell's safety awareness process, we commit to our customers to protect and safeguard our construction sites, our employees, sub-contractors, and your staff.

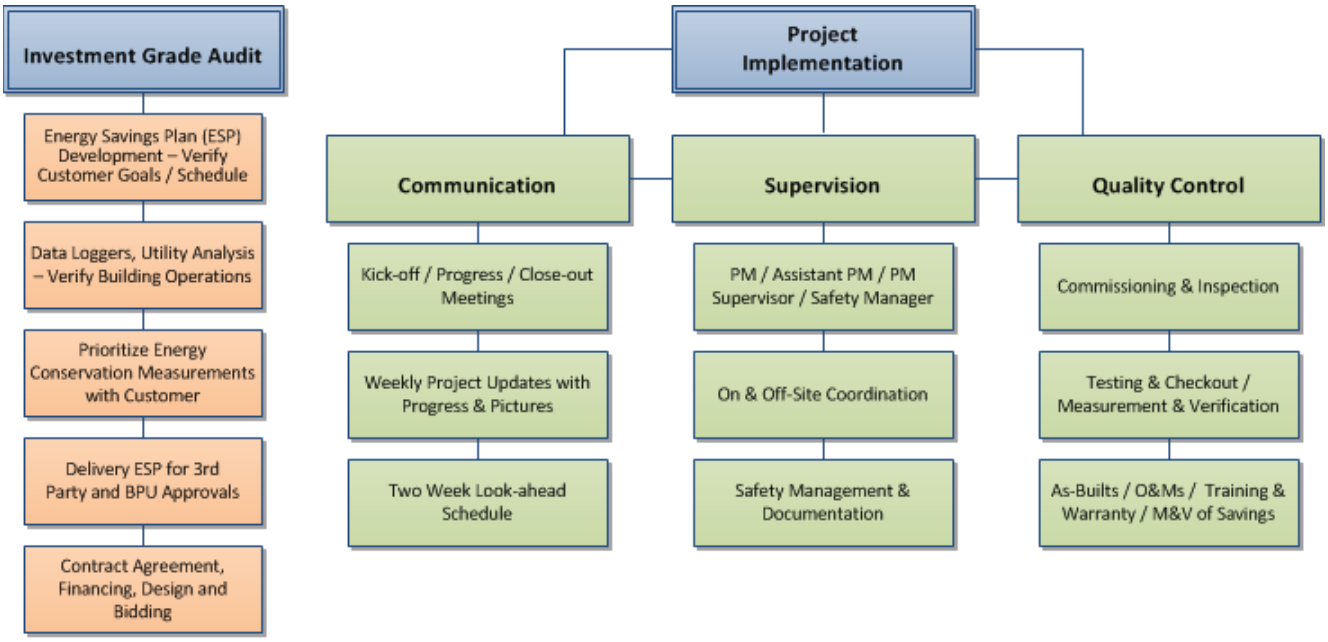
Our projects all begin with the following steps:

- Safety Training for Employee's and Sub-contractors
- Detailed Work Schedules around the day
- Detailed Background Checks of Personnel
- Detail Logs of Sub Contractor Personnel
- On-Site Logs of Time Sheets, Contact Information for All Personnel
- Clearly Displayed Identification Badges of All Construction Personnel
- On-Site Daily Supervision of All Sub-contractors
- Detailed and Weekly Reviews of Accident Reports and Remediation Strategy

We protect the safety and health of our customers and employees through prevention of illness, injury and pollution.

- We actively promote and develop opportunities for expanding sustainable capacity by increasing fuel efficiency, improving security and safety, and reducing emissions of harmful pollutants.
- We are committed to compliance with all of our health, safety, environmental and legal requirements everywhere we operate
- Our commitment to health, safety and the environment is an integral aspect of our design of products, processes and services, and of the lifecycle management of our products.
- Our management systems apply a global standard that provides protection of both human health and the environment during normal and emergency situations
- We identify, control and endeavor to reduce emissions, waste and inefficient use of resources and energy.
- We abide by the company's own strict standards in cases where local laws are less stringent.
- Our senior leadership and individual employees are accountable for their role in meeting our commitments.
- We measure and periodically review our progress and strive for continuous improvement.
- These are our commitments to health, safety, and the environment, and to creating a safe, clean environment everywhere we operate.

C. Project Management Process



The project management process applies technical knowledge, people and communication skills, and management talent in an on-site, pro-active manner to ensure that our contract commitments are met on time, within budget, and at the quality you expect.

A Honeywell Project Management Plan defines plans and controls the tasks that must be completed for your project. But more than task administration, our project management process oversees the efficient allocation of resources to complete those tasks.

Each project and each customer's requirements are unique. At Honeywell we address customer needs through a formal communication process. This begins by designating one of our project managers to be responsible for keeping the customer abreast of the status of the project.

As the facilities improvements portion of the partnership begins, the Project Manager serves as a single focal point of responsibility for all aspects of the partnership. The Project Manager monitors labor, material, and project modifications related to the Morris County Vocational School District/Honeywell partnership and makes changes to ensure achievement of performance requirements in the facilities modernization component. The Project Manager regularly reviews the on-going process of the project with the customers.

The Project Manager will develop and maintain effective on-going contact with the Morris County Vocational School District and all other project participants to resolve issues and update project status.

There are several challenges in this position. The Project Manager must staff the project and create a work force capable of handling the technologies associated with the project (pneumatic or electric/electronic controls, mechanical systems, etc.), and plan for and use these personnel to achieve optimum results focused on occupant comfort and guarantee requirements.

3. Construction Management

Prior to any work in the buildings, our Project Manager will sit down with your administrative and building staff to outline the energy conservation upgrades that we will be installing in their building. We will discuss proper contractor protocol of checking in and out of the buildings on a daily basis, wearing identifiable shirts, identification badges, and checking in with your facilities staff. We will coordinate certain projects for different times of the day so we do not interrupt the building and learning environments. Our staff will work a combination of first and second shifts to accomplish the pre-set implementation schedule.

Communication is the key success factor in any construction management plan, and our project manager will be the key focal point during the installation process.

Our team will prevent schedule slippages by continuously tracking the location of all equipment and components required for the project. We make sure all equipment and components will be delivered on time prior to the scheduled date of delivery. Our thorough survey, evaluation and analysis of existing conditions, performed prior to the commencement of construction, will also prevent schedule slippages.

Honeywell is required to subcontract various portions of our projects to contractors. Within the Morris County Vocational School District project, all subcontractors will be selected in accordance with New Jersey public contracts law. Typical areas that are subcontracted are as follows:

- Electrical Installation
- Lighting Retrofits
- HVAC Installation (depends upon the project size and scope)
- Associated General Contracting specialty items to support the project etc., (ceilings, windows, concrete, structural steel, roofing, demolition and removal of equipment, painting and rigging)

Where possible under New Jersey public contracts law, Honeywell uses the following guidelines in hiring subcontractors to perform work on our projects.

- Local Presence in the Community (Customer Recommendations)
- Firm's Qualifications and WBE/MBE Status
- Firm's Financial Stability
- Ability to perform the work within the project timeline
- Price
- Ability to provide service on the equipment or materials installed over a long period of time.

Approval of subcontractors that Honeywell proposes to use lies with the Morris County Vocational School District.

4. Commissioning

Honeywell provides full commissioning of energy conservation measures (ECM's) as part of our responsibility on this project. We will customize this process based on the complexity of ECMs. Specifically, Honeywell will be responsible for start-up and commissioning of the new equipment and systems to be installed during the project. This will include verifying that the installed equipment meets specifications, is installed and started up in accordance with manufacturer's recommendations, and operates as intended. A commissioning plan will be prepared that describes the functional tests to be performed on the equipment and the acceptance criteria.

Prior to customer acceptance of the project, Honeywell submits the final commissioning report containing signed acceptance sheets for each ECM. Signed acceptance sheets are obtained upon demonstrating the functionality of each ECM to a Morris County Vocational School District appointed representative.

Additionally, Honeywell provides training for facility operators and personnel as needed when each ECM is completed and placed into service. All training is documented in the final commissioning report.

After the completion of the Honeywell commissioning effort, in accordance with New Jersey ESIP legislation, the Morris County Vocational School District will be required to secure the services of a 3rd party independent firm in order to verify that the new equipment and systems meet the standards set forth in the Energy Savings Plan. To maintain the independence of this review, these costs must be born directly by the Morris County Vocational School District. However, at the option of the Morris County Vocational School District, these services can be financed as a portion of the total project cost.

5. Installation Standards

When Honeywell designs a solution, we consider current and future operations. For any upgrades, we install, we follow building codes/standards, which dictate certain standards for energy or building improvements. Listed in tables following this section are standards for building design. During the life of the agreement, there is a partnership approach to maintaining these standards for

reasons of comfort and reliability. For lighting our standard is to meet or exceed Illuminating Engineering Society (IES) light level requirements, achieving the relevant standards wherever possible.

In the case of fluorescent lighting upgrades, we recommend that a group re-lamping of lamps be done approximately five years after the initial installation depending upon run times. Your building facility staff, on an as needed basis, can complete normal routine maintenance of lamps and ballasts. This maintains the quality of the lighting levels, and color rendering qualities of the lamps.

Space temperatures will be set by the energy management system and local building controls, and will be maintained on an annual basis. Flexibility will be maintained to regulate space temperatures as required to accommodate building occupant needs.

Your facility staff and building personnel will operate the energy management system with ongoing training and support from Honeywell. Therefore, both the Morris County Vocational School District and Honeywell will maintain the standards of comfort. The comfort standards will be maintained throughout the life of the agreement through sound maintenance planning and services recommended as part of this ESP.

Regarding ventilation, Honeywell will upgrade ventilation to meet current standards in those areas where our scope of work involves upgrades to or replacement of systems providing building ventilation. We generally will not upgrade ventilation in those areas where our work doesn't involve the upgrade or replacement of systems or equipment providing ventilation to a building or facility.

A. Heating and Cooling Standards

Heating Temperatures	Cooling Temperatures	Unoccupied Temperatures
70-72° F	72-74° F	58-62° F

Honeywell uses a variety of in-house labor as well as subcontractors to install the energy conservation measures. We have on staff trained professionals in fire, security, energy management systems, all temperature control systems, and HVAC. However, per the ESIP law, all trades will be publicly bid except for specific controls applications. Listed below is a sampling of some of the disciplines that would apply to the Morris County Vocational School District:

Improvements	Honeywell	Subcontractor
Engineering Design/Analysis	X	
Technical Audit	X	
Construction Administration/Management	X	
On-Site Construction Supervision	X	
Installation of Energy Management System	X	X
Manufacturer of Energy Management Equipment	X	X
Installation of HVAC/Mechanical Equipment		X
Installation of Renewable Technology		X
Installation of Building Envelope		X
Energy Supply Management Analysis/Implementation	X	
Installation of Boilers		X
Maintenance of Energy Management Equipment	X	X
Manufacturer/Installation of Temperature Controls	X	X
Monitoring/Verification Guarantee	X	
Training of Owner Staff	X	
Financial Responsibility for Energy Guarantees	X	

B. Hazardous Waste Disposal or Recycling

Honeywell disposes of all PCB ballasts or mercury containing materials removed as part of the project per EPA guidelines. Honeywell will complete all of the required paperwork on behalf of the Morris County Vocational School District. Honeywell will work with the Morris County Vocational School District to review your hazardous material reports, and will identify the areas where work will be completed so that the Morris County Vocational School District can contract to have any necessary material abatement completed.

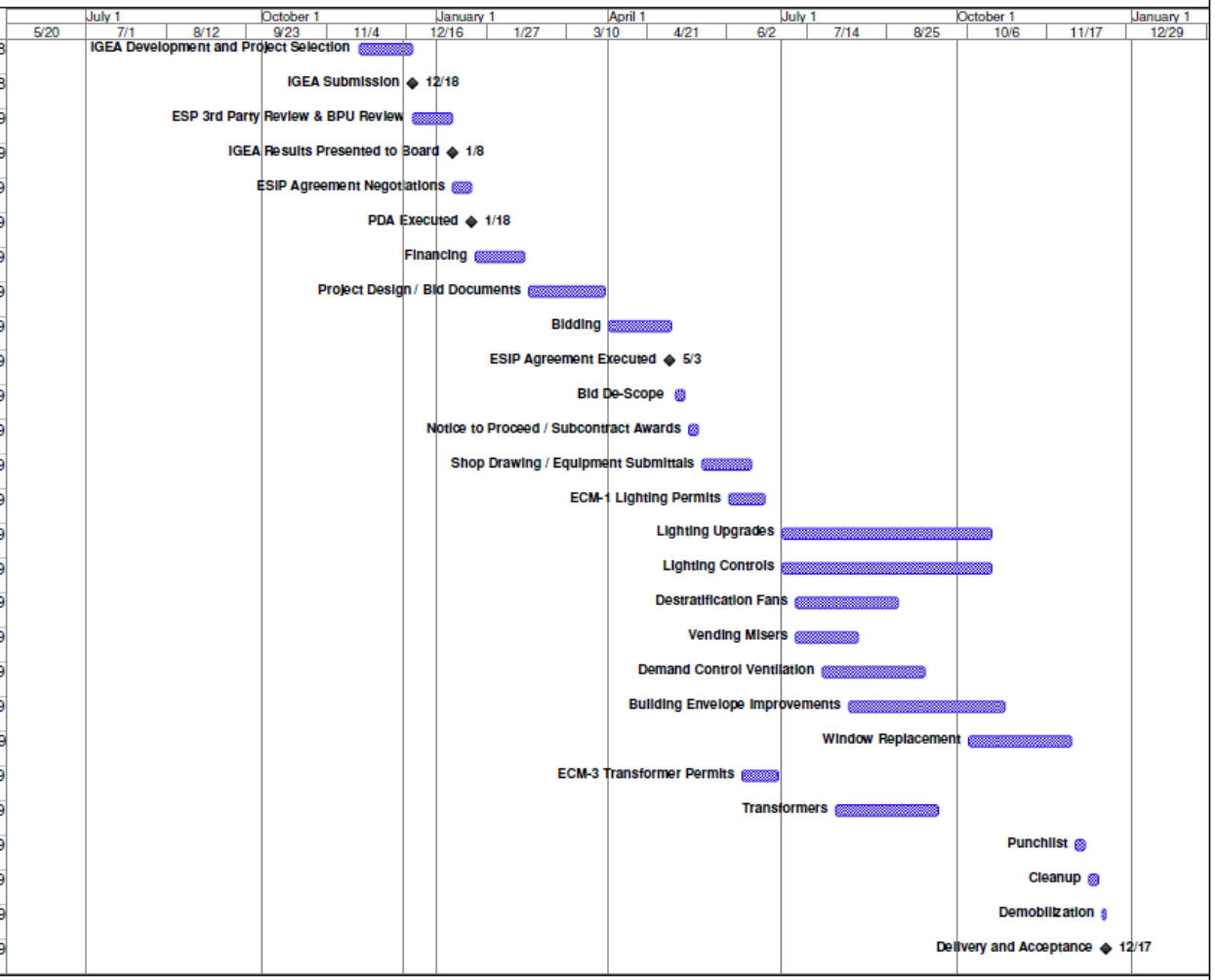
Honeywell can help schedule or coordinate waste removal, but does not contract for, or assume responsibility for, the abatement work. Honeywell also has the capabilities to assist the Morris County Vocational School District in working with the EPA under compliance management issues. We also develop and manufacture automated systems to track and report a wide variety of environmental factors.

6. Implementation Schedule

Attached please find a sample schedule for construction and completion of the Project.

Morris County Vo Tech
Honeywell Energy Project
ESP Schedule

ID	Task Name	Start	Finish
1	IGEA Development and Project Selection	Wed 11/21/18	Tue 12/18/18
2	IGEA Submission	Tue 12/18/18	Tue 12/18/18
3	ESP 3rd Party Review & BPU Review	Wed 12/19/18	Tue 1/8/19
4	IGEA Results Presented to Board	Tue 1/8/19	Tue 1/8/19
5	ESIP Agreement Negotiations	Wed 1/9/19	Fri 1/18/19
6	PDA Executed	Fri 1/18/19	Fri 1/18/19
7	Financing	Mon 1/21/19	Fri 2/15/19
8	Project Design / Bid Documents	Mon 2/18/19	Fri 3/29/19
9	Bidding	Mon 4/1/19	Fri 5/3/19
10	ESIP Agreement Executed	Fri 5/3/19	Fri 5/3/19
11	Bid De-Scope	Mon 5/6/19	Fri 5/10/19
12	Notice to Proceed / Subcontract Awards	Mon 5/13/19	Fri 5/17/19
13	Shop Drawing / Equipment Submittals	Mon 5/20/19	Fri 6/14/19
14	ECM-1 Lighting Permits	Mon 6/3/19	Fri 6/21/19
15	Lighting Upgrades	Mon 7/1/19	Fri 10/18/19
16	Lighting Controls	Mon 7/1/19	Fri 10/18/19
17	Destratification Fans	Mon 7/8/19	Fri 8/30/19
18	Vending Misers	Mon 7/8/19	Fri 8/9/19
19	Demand Control Ventilation	Mon 7/22/19	Fri 9/13/19
20	Building Envelope Improvements	Mon 8/5/19	Fri 10/25/19
21	Window Replacement	Mon 10/7/19	Fri 11/29/19
22	ECM-3 Transformer Permits	Mon 6/10/19	Fri 6/28/19
23	Transformers	Mon 7/29/19	Fri 9/20/19
24	Punchlist	Mon 12/2/19	Fri 12/6/19
25	Cleanup	Mon 12/9/19	Fri 12/13/19
26	Demobilization	Mon 12/16/19	Tue 12/17/19
27	Delivery and Acceptance	Tue 12/17/19	Tue 12/17/19



Project: Morris County Vo Tech
Date: Fri 12/14/18

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Progress | Deadline

Page 1

Morris County Vo Tech ESP Schedule_Rev1.mpp

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APPENDIX 1 INDEPENDENT ENERGY AUDIT

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MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 1

400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the campus was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 1 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 1	400 E Main St, Denville, NJ 07834	45,945	1956

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
412,470	7,122	55,029	20.9

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

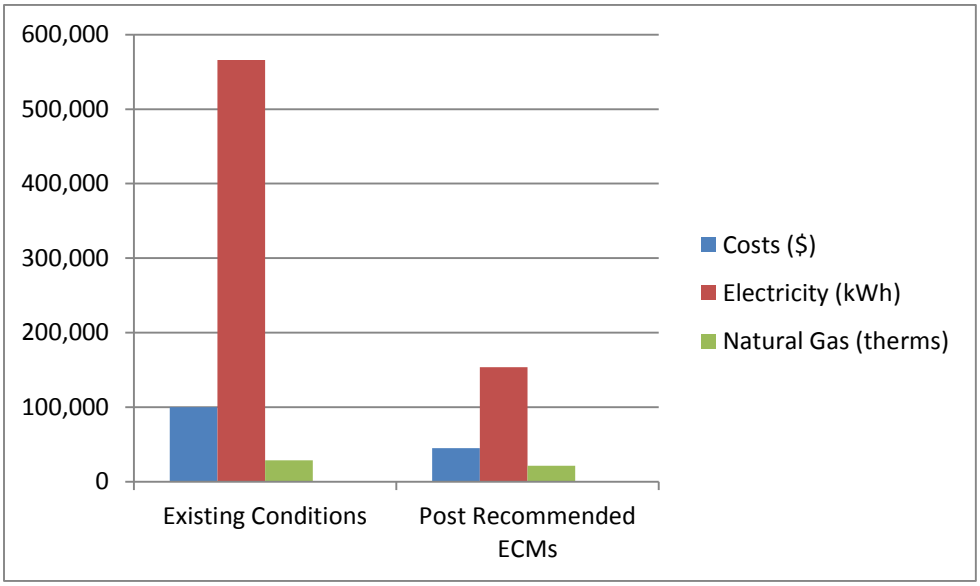
Summary of Energy Conservation Measures

ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Replace Windows	258,554	1,540	167.9	0	167.9	Y
2	Replace Door Seals	2,305	414	5.6	0	5.6	Y
3	Replace RTUs	260,100	7,273	35.8	8,146	34.6	Y
4	Replace Electric Heat with Natural Gas	18,000	1,517	11.9	0	11.9	Y
5	Condensing DHW Boiler	72,167	861	83.8	700	83.0	Y
6	Replace Electric Kitchen Equipment with Natural Gas	147,816	5,828	25.4	3,498	24.8	Y
7	Replace Reach-In Refrigeration Units with Walk-In Units	87,589	2,558	34.2	0	34.2	Y
8	Kitchen Hood Controls	39,678	14,869	2.7	1,500	2.6	Y
9	Dishwasher Booster Heater Conversion	16,800	1,269	13.2	3,500	10.5	Y
10	Vending Machine Controls	1,401	1,675	0.8	150	0.7	Y
11	Computer Network Controller	1,776	1,554	1.1	0	1.1	Y
12	Install Low Flow Plumbing Fixtures	60,495	1,246	48.6	0	48.6	Y
L1**	Lighting Replacements / Upgrades	224,832	12,825	17.5	38,035	14.6	N
L2**	Install Lighting Controls (Add Occupancy Sensors)	17,820	4,780	3.7	2,310	3.2	N
L3	Lighting Replacements with Controls (Occupancy Sensors)	242,652	14,424	16.8	40,345	14.0	Y
	Total**	1,209,331	55,029	22	57,839	20.9	
	Total (Recommended)	1,209,331	55,029	22	57,839	20.9	

* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	99,206	44,178	55%
Electricity (kWh)	566,039	153,569	73%
Natural Gas (therms)	28,516	21,394	25%
Site EUI (kbtu/SF/Yr)	104.1	58.0	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 1
Gross Floor Area: 45,945
Number of Floors: 1
Year Built: 1956
Additions: Building 2 & Building 6



Description of Spaces: Classrooms, offices, cafeteria, kitchen, gymnasium, computer lab, storage rooms, toilet rooms and a mechanical room.
Description of Occupancy: This building houses classroom spaces for secondary or high school level and post-secondary/adult vocational and technical education. There are approximately 195 students and staff occupying this building.
Number of Computers: The school has approximately 185 desktop computers.
Building Usage: The secondary school hours of operation are 8:15 AM – 3:00 PM Monday through Friday, with various post-secondary activities until 6:00 PM. Custodians are in the building until 11:00 each night. In general the occupied hours are considered 80 hours per week, 10 months per year

Building Envelope

Construction Materials: Steel framed concrete masonry unit (CMU) exterior walls
Façade: Brick exterior fascia
Roof: Concrete and metal roof decking with minimal insulation, rolled asphalt and white stone ballast. The roof appeared to be in fair condition and no ECMs were assessed.
Windows: Single pane aluminum frame with interior storm windows installed in most locations. The windows are in poor condition. An ECM is included that evaluates the energy savings associated with installing the new windows.
Exterior Doors: Single and double pane full window doors with aluminum frames. These doors appear to be in fair condition and no ECMs were assessed.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating & Cooling: Heating and cooling for the majority building is provided by (25) natural gas-fired, packaged, direct expansion (DX) rooftop units (RTUs). The RTUs are of various ages, sizes and manufacturers including Trane, Carrier, Lennox and York. These units all serve constant volume ducted distribution systems and provide heating and cooling to all of the spaces.

The Kitchen is heated by a natural gas fired, heating only Reznor make-up air unit providing a constant 17,000 CFM of conditioned air to replace what is exhausted by the three (3) kitchen hood exhaust fans (described below).

The gym, locker rooms and fitness center are all served by a Des Champs plate-style energy recovery rooftop unit (ERU) having natural gas heat that is paired with a Trane air cooled condensing unit (ACCU) for cooling.

The cafeteria and faculty dining room are each served by a packaged DX-ERU manufactured by Addison which uses desiccant wheel energy recovery technology.

The rear food storage room and corridor are currently heated by one electric unit heater in the storage room and wall mounted cabinet unit heater in the corridor. An ECM has been included to replace older RTUs with new high efficiency equivalents, and to replace electric heat with natural gas heat in the food storage area.

Ventilation: The RTUs described above provide ventilation to the spaces they serve at a fixed minimum level when the building is occupied. Ventilation is being provided at a constant rate and no units are modulating airflow. An ECM has been included to install variable speed drives and controls to the kitchen hood exhaust and makeup air supply fan motors to allow for variable airflow through these systems to match requirements of the kitchen.

Controls Systems

This building controls are currently being upgraded to include a modern building automation system (BAS) as part of a campus-wide controls improvement project. This project will include upgrading all terminal controls devices such as damper actuators and control valves as well as the front-end controls software and user interface will be upgraded to allow for full HVAC control of all equipment. The present system is pneumatically operated controls.

Currently, the space temperature set points are 76°F occupied and 85°F unoccupied for cooling, and 72°F occupied and 60°F unoccupied for heating. The space humidity set point is 60% relative humidity at all times. All spaces contain wall mounted thermostats that provide a graphic readout of the current space temperature and allows for occupant adjustment of ±2F. The majority of the RTUs have been provided with dual-enthalpy economizer control to allow for free cooling to occur when weather conditions allow. The current controls system does not appear to provide demand controlled ventilation for spaces with varying occupancy, but this sequence is expected to be implemented with the new system.

Although the system was not completely installed during the building walkthrough, the BAS system specifications provided by the engineer appear to provide very complete HVAC control. It is assumed that all of the system components will be in new condition once the installation of the system is completed, therefore no controls related ECMs have been included.

Domestic Hot Water Systems

Domestic hot water (DHW) is generated by one AO Smith hot water boiler that is paired with a 400 gallon DHW storage tank. This DHW system is in fair condition, but is reaching the end of its useful life. It is estimated that this existing system creates DHW at an overall efficiency of approximately 78%. Domestic hot water is stored in the tank and used throughout the building for lavatories, dishwashing sinks in the kitchen, and showers.

An ECM has been included which evaluates the savings associated with replacing the existing DHW heating system with more efficient condensing technology.

Kitchen Equipment

The kitchen contains both natural gas and electric cooking appliances. All of the combination oven/range units are natural gas-fired and appear to be in good condition. There are a total of (6) cooking appliances that are electric which consist of; (2) fryers and (4) warming ovens. In addition to the electric cooking appliances, the dishwasher utilizes an electric booster heater which boosts the domestic hot water from 140°F to 180°F for dish washing sanitization.

The kitchen also contains (6) reach-in style freezers and (3) reach-in style refrigerators. Although the majority of these units were in good condition, two of them appeared to have deficiencies including leaking door seals and refrigerator compressors that had frozen up.

The cafeteria houses additional food storage in the form of (2) additional reach-in style refrigerators as well as (2) heated and (2) refrigerated display cases.

In general, the equipment located in the kitchen and cafeteria is in fair to good condition. Although the equipment appears to be operating properly, the electric kitchen appliances could all be replaced with natural gas appliances to provide for a utility cost reduction.

An ECM has been included to replace all electric cooking equipment with natural gas cooking equipment. A second ECM has been included to replace the reach-in style refrigeration equipment with more efficient walk-in refrigeration units.

Plug Load

This school has computers, LCD monitors copiers, smart boards, residential appliances (microwave, refrigerator), printers, portable electric heaters (personal) and vending machines which contribute to the plug load in the building. The installation of vending machine occupancy sensors and a computer network controller has been evaluated in ECMs in an effort to reduce the plug load in the building.

Plumbing Systems

This building contains about a 50/50 mixture of low and high flow water fixtures in the bathrooms and locker room spaces. Water closets consume either 3.0 gallons per flush (GPF – high flow) 1.6 GPF. Urinals consume either over 2.0 GPF or under 1.0 GPF. Sinks consume either 2.0 gallons per minute (GPM) or approximately 0.5 GPM. All of the showers that are used within the locker rooms are high flow, consuming 2.5 GPM.

An ECM is included to evaluate the water savings potential of installing low- flow plumbing fixtures to replace the high flow units described above.

Lighting Systems

The lighting systems serving the majority of the hallways and classroom spaces consist of predominantly 4' linear fluorescent fixtures utilizing 32-watt T-8 lamps or 34-watt T-12 lamps. The lighting serving the gym and fitness center consists of high bay and 2'x2' troffer fixtures that utilize 40-watt compact fluorescent quad-pin lamps. The lighting system in the fitness center and the main office area is supplemented by several reflective sky lights that provide a significant amount of daylight to the spaces. The gym also has a very large opaque skylight located within the center of the ceiling that offers significant daylight to the space. All exit signs in this building have been upgraded to LED fixtures. The majority of incandescent or PAR halogen lights have been upgraded to compact fluorescent bulbs, although a few incandescent bulbs still remain in desk lamps in a couple of offices. All of the lighting within this building is manually controlled by wall mounted switches.

Exterior lighting on this building consists of six (6) 70-watt mercury vapor wall pack fixtures and one (1) 175-watt mercury vapor wall pack. All of the lighting serving the main parking lot is utility owned. The exterior lighting installed on the walls is controlled by photo sensors.

Three lighting ECMs have been included which include adding occupancy sensors to the existing lighting, replacement of the T-8 lighting with LED lighting and a third ECM that evaluates the effect of occupancy sensors used with the LED lighting upgrades.

3.0 UTILITIES

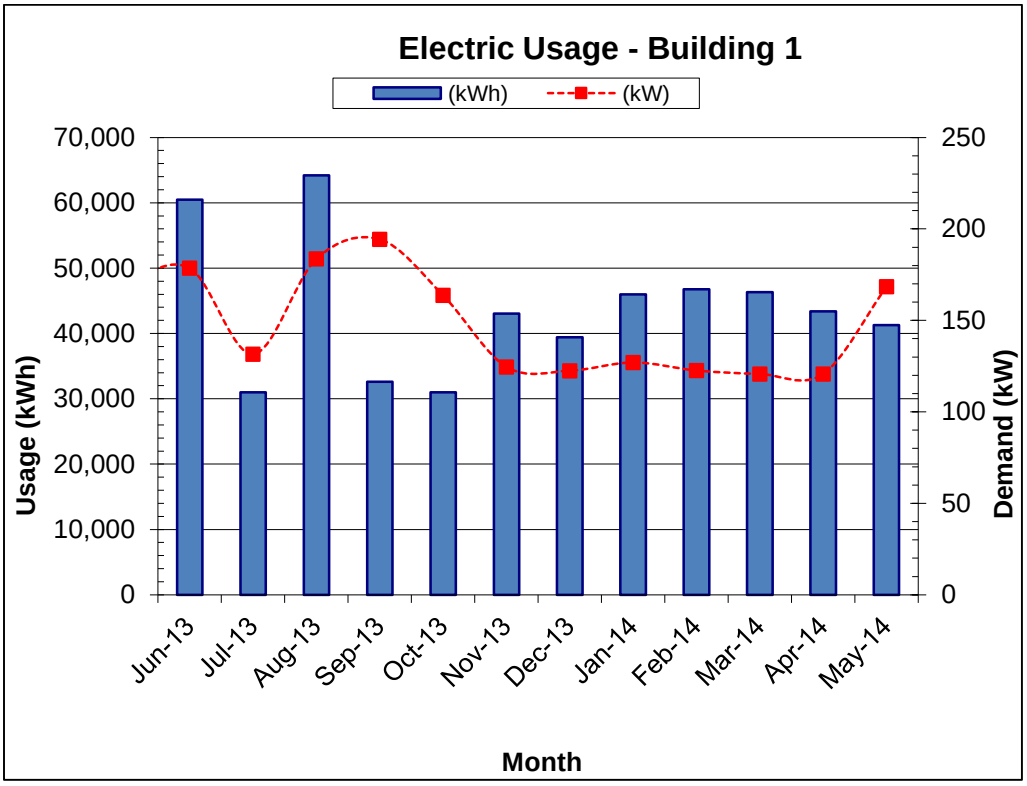
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	First Energy Solutions Corp.	New Jersey Natural Gas

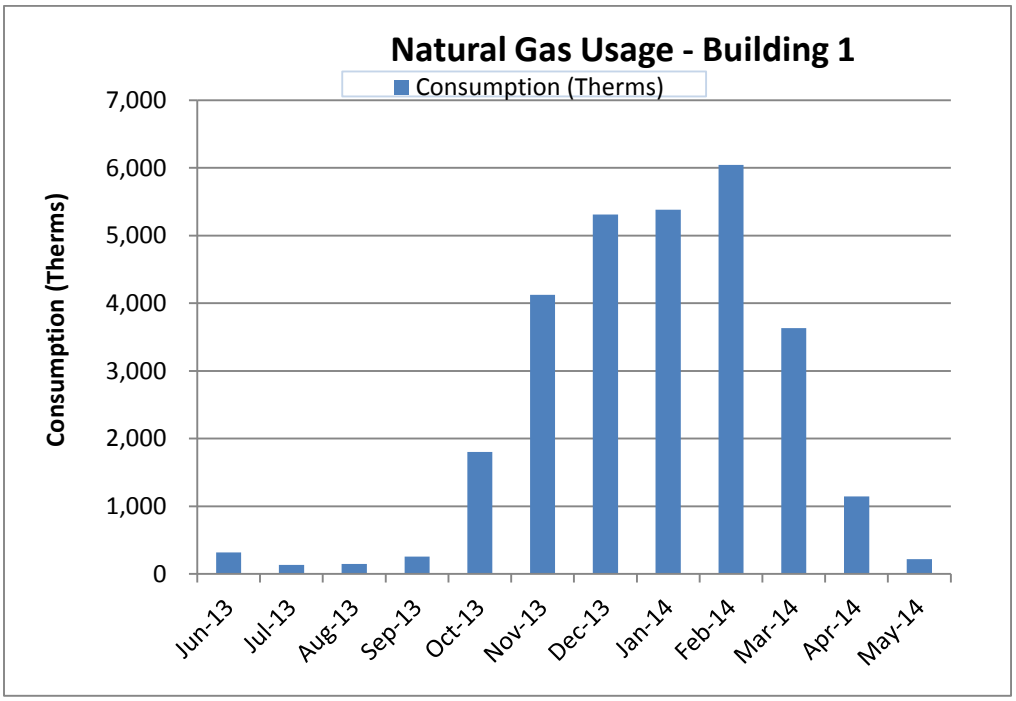
For the 12-month period ending in December 2013, the utilities usages and costs for the building were as follows:

Electric		
Annual Consumption	566,039	kWh
Annual Cost	67,089	$
Blended Unit Rate	0.119	$/kWh
Supply Rate	0.091	$/kWh
Demand Rate	3.38	$/kW
Peak Demand	194.4	kW
Natural Gas		
Annual Consumption	28,516	Therms
Annual Cost	32,117	$
Unit Rate	1.126	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



The electric usage presented in the graph above shows consumption that is typical of an air conditioned school, with peak electrical consumption and demand associated with summer months when cooling is in operation. Usage and demand appear to be low in the month of July, 2013 which may be the result of the school being mostly shut down during that month.



The natural gas consumption presented in the graph above is typical of a school building with peak consumption occurring during the winter months when the heating load is at it's highest. From the graph, it is easy to tell that the consumption during the summer is predominantly used for domestic water heating as the building is not being heated and the kitchen is not in use.

In addition, domestic water and sewer services are provided by the Township of Denville at $9.00/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.09	$0.13	N

Natural Gas	$/Therm	$0.94	$0.96	N
Fuel Oil	$/Gal	NA	$3.62	NA

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

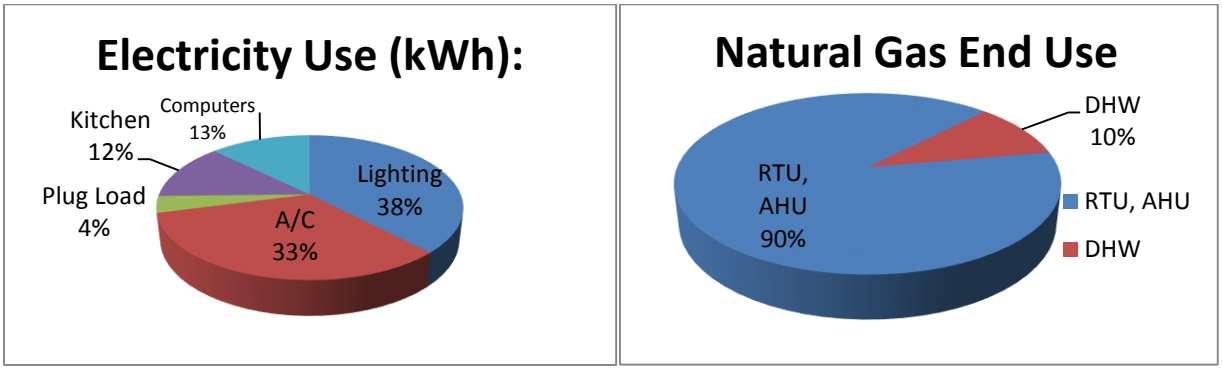
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

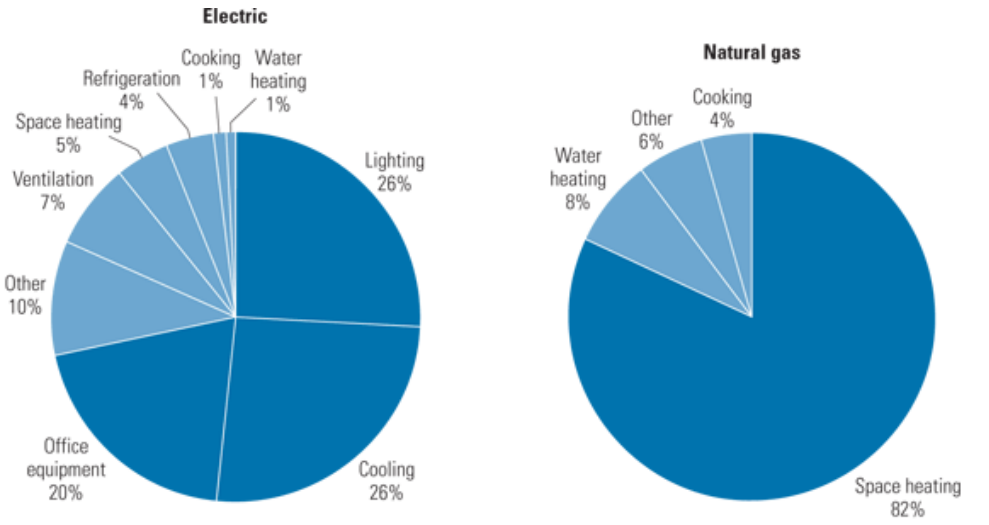
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
101.1	187.7	38

The school has a below average Energy Star Rating Score (50 being the median score), and as such by implementing the measures discussed in this report, it is expected that the EUI can be further reduced and the Energy Star Rating further increased. EPA Portfolio Manager data is found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Replace Windows

The existing windows at this building appear to be original and utilize single pane glazing and aluminum frames. There are interior and exterior storm windows installed in some locations that add some additional insulation value, but do not help to improve the sealing of the existing windows. It is proposed to replace all of the windows at this building with new vinyl framed windows with double pane glazing and low-e coating. The new windows will reduce overall heat gain/loss and infiltration which will reduce the overall loads on the heating and cooling systems. Energy savings in the form of electricity and natural gas will result from these reduced heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Replace Windows

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
258,554	0	944	1,267	0	1,540	(0.9)	0	167.9	167.9

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended because it was requested by the school district.

5.2 ECM-2 Replace Door Seals

The exterior doors have deteriorating sweeps and seals which allow for excessive building infiltration/exfiltration and increased heating and cooling loads. It is proposed to install new door sweeps and seals on all of the exterior doors to reduce this infiltration/exfiltration. Energy savings in the form of electricity and natural gas will result from this reduction of heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Replace Door Seals

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
2,305	0	505	314	0	414	0.8	0	5.6	5.6

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.3 ECM-3 Replace RTUs

There are approximately (19) rooftop units that are nearing the end of their useful life. These units utilize natural gas for heating and direct expansion (DX) refrigeration for cooling. It is assumed that the average cooling energy efficiency rating (EER) of these units is approximately 11 based on their age, and the heating efficiency is approximately 78% based on manufacturer ratings. It is proposed to replace these RTUs with new high efficiency equivalents which have an expected cooling EER of 18 and heating efficiency of 80%. Electrical and natural gas savings will result from improved efficiency ratings of the new units.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-3 Replace RTUs

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
260,100	28.3	47,742	1,625	0	7,273	(0.5)	8,146	35.8	34.6

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the equipment effected has reached the end of its useful life.

5.4 ECM-4 Replace Electric Heat with Natural Gas

The rear food storage room and corridor are currently heated by one electric unit heater in the storage room and wall mounted cabinet unit heater in the corridor. Although these units are in fair condition, they are expensive to operate due to the high cost of electricity. It is proposed to install natural gas fired unit heaters in these spaces to reduce the operating cost of heating them. Cost savings will result from a lower energy cost of natural gas versus electricity.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-4 Replace Electric Heat to Natural Gas

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
18,000	0	18,593	(634)	0	1,517	0.3	0	11.9	11.9

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.5 ECM-5 Condensing DHW Boiler

The existing domestic hot water heating system consists of one 78% efficiency natural gas-fired AO Smith boiler and one 400 gallon hot water storage tank. DHW stored in the storage tank is kept at 140°F year round based on field observations. It is proposed to replace the existing DHW system with a new natural gas-fired condensing DHW boiler and indirect storage tanks. It is also proposed to slightly reduce the total storage volume to 360 gallons, as it was determined that this system is oversized. This proposed system will operate at a seasonal efficiency of 96% or greater year round. Natural gas savings will result from increased system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-5 Condensing DHW Boiler

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
72,167	0	0	765	0	861	(0.7)	700	83.8	83.0

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the equipment effected is nearing the end of its useful life.

5.6 ECM-6 Replace Electric Kitchen Equipment with Natural Gas

There are currently (2) fryers and (4) warming ovens in the kitchen that utilize electricity for cooking or warming food. Although this equipment is in good condition, it is expensive to use them due to the high price of electricity. It is proposed to replace this electric kitchen equipment with natural gas-fired units with the same cooking and/or storage capacity. Cost savings will result from the lower cost of natural gas.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-6 Replace Electric Kitchen Equipment with Natural Gas

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
147,816	0	71,440	(2,438)	0	5,828	(0.4)	3,498	25.4	24.8

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.7 ECM-7 Replace Reach-In Refrigeration Units with Walk-In Units

The kitchen and cafeteria currently have (5) reach-in style refrigerators and (6) reach-in style freezers. Most of these units appeared to be in good condition, except one freezer that had a compressor that appeared to be frozen during the field visit. Although they are in good condition, operating multiple units with refrigeration compressors located in the warm kitchen area is inefficient as compared to one consolidated walk in cooler or freezer. It is proposed to install one large combination refrigerator/freezer walk-in unit along the exterior wall next to the kitchen. This new walk-in unit will consume less electrical energy than the multiple reach-in style units over the course of the year while maintaining the same amount of storage area.

Energy savings for this measure is dependent on utilizing only the proposed walk-in style refrigerator/freezer. If the existing reach-in units and the walk-in unit are both used, the system will consume more energy than what is currently being consumed.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-7 Replace Reach-In Refrigeration Units with Walk-In Units

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
87,589	0	21,316	0	0	2,558	(0.6)	0	34.2	34.2

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.8 ECM-8 Kitchen Hood Controls

The existing kitchen hood exhaust and make-up air units are currently being manually operated by switches located within the kitchen. These systems are typically left on all day during the school year and are shut off by maintenance staff at the end of each day. It is proposed to install variable speed drives on the (4) roof mounted exhaust fan motors and make-up air unit supply fan motor connected to controls to allow for modulation of exhaust and outside air. The proposed system will include sensors within the kitchen hoods that will measure the amount of smoke or steam and increase or decrease system airflow to match the actual needs of the kitchen. Electrical energy savings will result from reduced fan motor run time, and natural gas savings will result from a reduction in the amount of outside air that must be treated by the make-up air unit.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-8 Kitchen Hood Controls

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
39,678	0	59,645	6,848	0	14,869	4.6	1,500	2.7	2.6

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.9 ECM-9 Dishwasher Booster Heater Conversion

The existing dishwasher domestic hot water booster heater is electric, rated at 15 kW. This unit boosts the DHW from 140°F system temperature to the required 180°F for sanitization in the dishwasher. Although the booster heater is in good condition, it is expensive to operate due to the high cost of electricity. It is proposed to install a natural gas-fired booster heater of equivalent size. Cost savings will result due to the lower cost of natural gas.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-9 Dishwasher Booster Heater Conversion

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
16,800	7.0	23,447	(1,000)	0	1,269	0.8	3,500	13.2	10.5

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.10 ECM-10 Vending Machine Controls

There are several vending machines located in the cafeteria and in the vending area next to the gym. These units are on 24/7 and currently have no way of reducing electrical energy consumption at times of limited or no occupancy. It is proposed to install vending machine controls which will reduce the total electrical energy consumption by turning off lights and cycling refrigeration compressors when there is nobody near them. The controls work somewhat like an occupancy sensor for lighting and will turn the vending machine lights and refrigeration back up when someone walks in front of the machine. Electrical energy savings will result from reduced operating hours of the lighting and refrigeration components of the vending machines.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-10 Vending Machine Controls

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
1,401	0	13,960	0	0	1,675	16.9	150	0.8	0.7

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.11 ECM-11 Computer Network Controller

There are approximately 185 desktop computers used in classrooms and computer rooms in the building. These computers are generally left on when the spaces are unoccupied. Although there are sleep and/or hibernate functions built into the computers, there is more advanced computer network control software which will allow for the units to reduce standby electrical energy consumption even further when the computers are not in use. Electrical energy savings will result from lower standby power draw of the computers during unoccupied hours.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-11 Computer Network Controller

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
1,776	0	12,950	0	0	1,554	12.1	0	1.1	1.1

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.12 ECM-12 Install Low Flow Plumbing Fixtures

Some plumbing fixtures are older high flow fixtures. The water savings associated from replacing existing high flow fixtures with low-flow fixtures was calculated by taking the difference of the annual water usage for the proposed and base case. The basis of this calculation is the estimate usage of each fixture, gallons per use, and number of fixtures. Replacing the existing fixtures in the restrooms with 1.28 Gals/flush toilets, 0.125 gal/flush urinals, and 0.5 gpm aerators will conserve water which will result in lower annual water and sewer charges.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-5 Install Low Flow Plumbing Fixtures

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
60,495	0	0	375	92	1,246	(0.4)	0	48.6	48.6

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.13.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of mostly T8 linear fluorescent fixtures which until recently represented the most efficient lighting technology available. Exterior lighting includes 1000W wall mounted area light fixtures. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
224,382	40.7	124,163	0	12,825	0.1	38,035	17.5	14.6

* LED retrofits must go through the “custom” measures incentive option under New Jersey SmartStart Program. There are no “prescriptive” incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for “custom” incentives. See section 6.0 for other incentive opportunities

This measure is not recommended in lieu of ECM L3.

5.13.2 ECM-L2 Install Lighting Controls (Occupancy Sensors)

Presently, all interior lighting fixtures are controlled my wall mounted switches. Review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied.

This measure recommends installing occupancy sensors for the current lighting system. Using a process similar to that utilized in Section 5.7.1, the energy savings for this measure was calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L2 Install Lighting Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
17,820	0	39,834	0	4,780	3.0	2,310	3.7	3.2

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is not recommended in lieu of ECM L3.

5.13.3 ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

This measure is a combination of ECM-L1 and ECM-L2; recommending replace/upgrade the current lighting fixtures to more efficient ones and installing occupancy sensors on the new lights. Interactive effects of the higher efficiency lights and occupancy sensors lead the energy and cost savings for this measure to not be cumulative or equivalent to the sum of replacing the lighting fixtures alone and installing occupancy sensors without the lighting upgrade. The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
242,652	40.7	141,929	0	14,424	0.2	40,345	16.8	14.0

* LED retrofits must go through the “custom” measures incentive option under New Jersey SmartStart Program. There are no “prescriptive” incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for “custom” incentives. See section 6.0 for other incentive opportunities

This measure is recommended.

5.14 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Clean or replace air handler filters before each season
- Set computer monitors to turn off and computers to sleep mode when not in use
- Look for the ENERGY STAR® label when purchasing residential Kitchen Appliances
- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train staff to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate students and staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.50/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.05 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding

bonds or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. However due to the unavailability of space a solar photovoltaic setup is not practical at this location.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

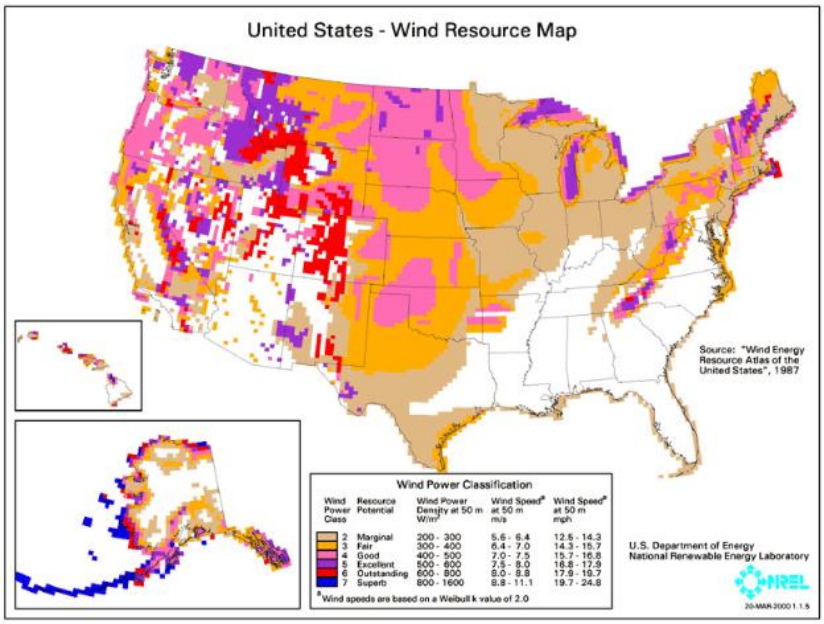
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development

Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by JCP&L, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

This school district is already involved with a demand response program.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building 1.

The following projects should be considered for implementation:

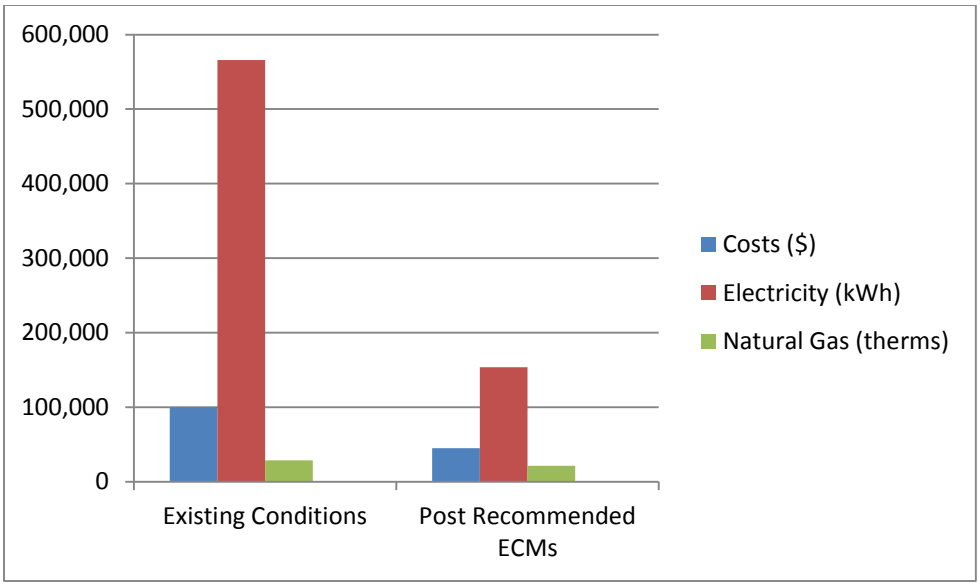
- Replace Windows
- Replace Door Seals
- Replace RTU's
- Replace Electric Heat with Natural Gas
- Condensing DHW Boiler
- Replace Electric Kitchen Equipment with Natural Gas
- Replace Reach-In Refrigeration Units with Walk-In Units
- Kitchen Hood Controls
- Dishwasher Booster Heater Conversion
- Vending Machine Controls
- Computer Network Controller
- Install Low Flow Plumbing Fixtures
- Lighting Replacements with Controls

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
412,470	7,122	55,029	20.9

If Morris County Vocational School Districts implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	99,206	44,178	55%
Electricity (kWh)	566,039	153,569	73%
Natural Gas (therms)	28,516	21,394	25%
Site EUI (kbtu/SF/Yr)	104.1	58.0	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 1 Account Data
400 East Main Street, Denville, NJ 07834

Annual Utilities

12-month Summary

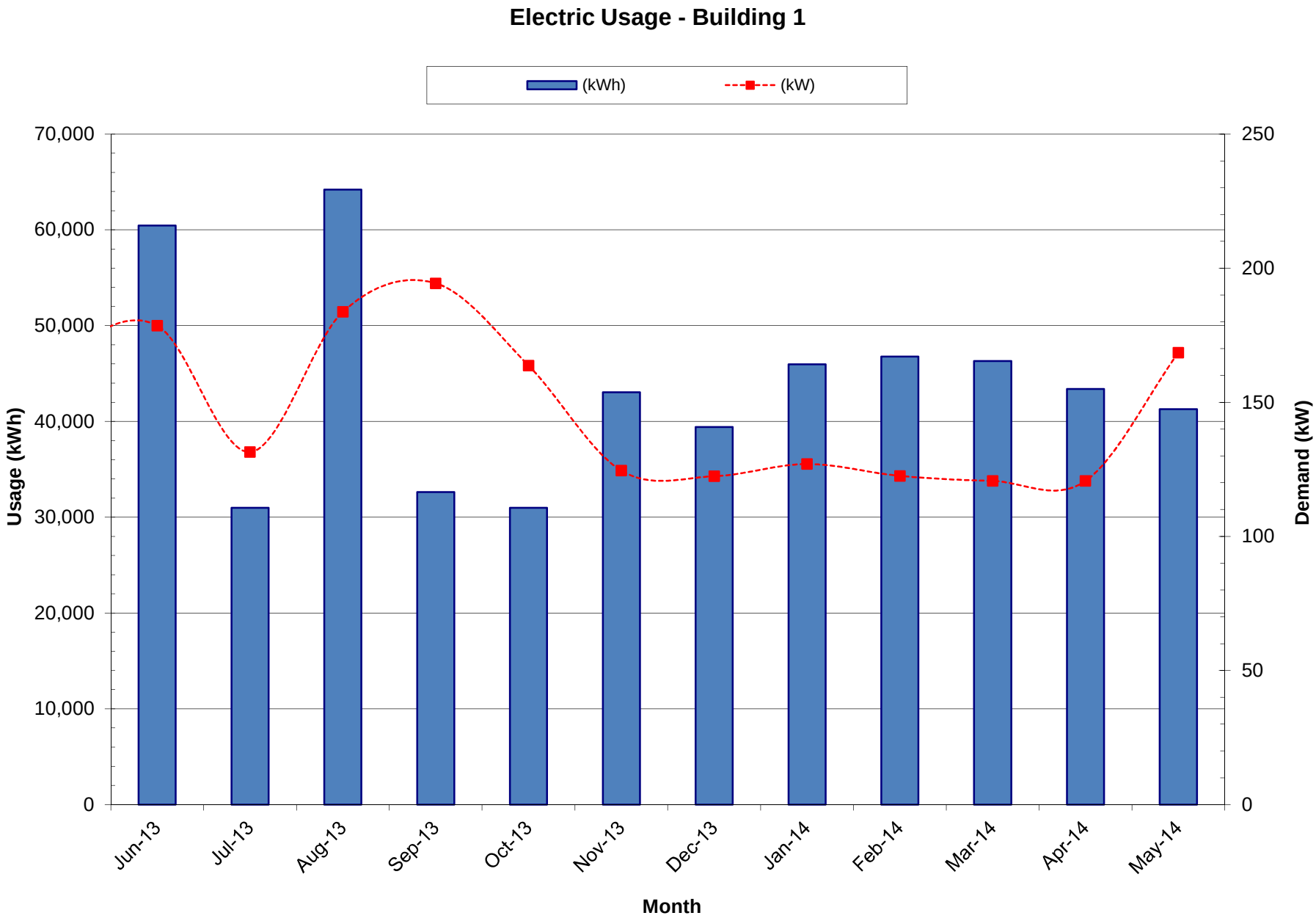
Electric		
Annual Usage	566,039	kWh/yr
Annual Cost	67,089	$
Blended Rate	0.119	$/kWh
Consumption Rate	0.091	$/kWh
Demand Rate	3.38	$/kW
Peak Demand	194.4	kW
Min. Demand	117.2	kW
Avg. Demand	147.9	kW
Natural Gas		
Annual Usage	28,516	Therms/yr
Annual Cost	32,117	$
Rate	1.126	$/therm
Water		
Annual Usage	820	gallons/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 1 Account Data
400 East Main Street, Denville, NJ 07834

For Service at:	**Building 1**					
Account No.:	**100000077717**	**Delivery -**	JCP & L	Building Area	45,945	SF
Meter No.:	**L86699237**	**Supplier -**	First Energy Solutions Corp.	% of Total Area Served	36.5%	%
Electric Service						

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	**Consump. (kWh)**	**Demand (kW)**	**Delivery ($)**	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Blended Rate ($/kWh)**	**Consumption ($/kWh)**	**Demand ($/kW)**
May-12	36,605	168.5	5,882.86	0.00	4,734.40	3,565.14	1,169.26	0.13	0.10	6.94
June-12	42,570	196.3	6,636.77	0.00	6,636.77	5,274.24	1,362.53	0.16	0.12	6.94
July-12	30,992	127.8	4,734.40	0.00	4,734.40	3,847.44	886.97	0.15	0.12	6.94
August-12	49,587	146.5	1,909.22	0.00	1,909.22	892.39	1,016.83	0.04	0.02	6.94
September-12	34,617	194.4	1,884.20	0.00	1,884.20	626.71	1,257.49	0.05	0.02	6.47
October-12	41,166	171.0	1,842.77	0.00	1,842.77	736.61	1,106.16	0.04	0.02	6.47
November-12	37,775	124.5	1,483.76	0.00	1,483.76	678.15	805.62	0.04	0.02	6.47
December-12	44,675	126.1	1,573.94	0.00	1,573.94	785.46	788.48	0.04	0.02	6.25
January-13	43,389	117.2	1,501.33	0.00	1,501.33	743.24	758.09	0.03	0.02	6.47
February-13	48,067	123.3	1,618.54	0.00	1,618.54	820.49	798.05	0.03	0.02	6.47
March-13	39,997	136.7	1,571.53	0.00	1,571.53	687.17	884.36	0.04	0.02	6.47
April-13	41,751	137.5	1,605.70	0.00	1,605.70	716.14	889.56	0.04	0.02	6.47
May-13	40,582	168.5	1,867.72	3,242.48	5,110.20	3,940.94	1,169.26	0.13	0.10	6.94
June-13	60,463	178.6	2,266.06	4,831.02	7,097.08	5,857.82	1,239.26	0.12	0.10	6.94
July-13	30,992	131.5	1,426.96	2,476.25	3,903.21	0.00	886.97	0.13	0.00	6.75
August-13	64,206	183.7	2,363.44	5,130.03	7,493.47	6,218.70	1,274.77	0.12	0.10	6.94
September-13	32,629	194.4	1,824.84	2,607.07	4,431.91	3,174.42	1,257.49	0.14	0.10	6.47
October-13	30,992	163.7	1,238.90	2,476.25	3,715.14	3,009.08	706.07	0.12	0.10	4.31
November-13	43,038	124.5	1,547.38	3,438.70	4,986.09	4,180.47	805.62	0.12	0.10	6.47
December-13	39,412	122.4	1,458.18	3,149.04	4,607.22	3,815.09	792.14	0.12	0.10	6.47
January-14	45,961	127.0	1,544.44	3,672.32	5,216.76	4,395.30	821.46	0.11	0.10	6.47
February-14	46,780	122.5	1,528.23	3,737.73	5,265.96	4,473.11	792.85	0.11	0.10	6.47
March-14	46,312	120.7	1,509.06	3,700.35	5,209.41	4,428.62	780.79	0.11	0.10	6.47
April-14	43,389	120.7	1,464.74	3,466.75	4,931.49	4,150.70	780.79	0.11	0.10	6.47
May-14	41,283	168.5	1,822.98	3,298.55	5,121.53	3,952.26	1,169.26	0.12	0.10	6.94
Total (All)	**1,057,230**	**196.33**	**$54,107.96**	**$45,226.52**	**$98,186.02**	**$70,969.70**	**$24,200.08**	**$0.09**	**$0.07**	**$6.55**
Total (last 12-months)	**566,039**	**194.36**	**$54,107.96**	**$45,226.52**	**$67,089.46**	**$51,596.51**	**$12,476.71**	**$0.12**	**$0.09**	**$3.38**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)



Utility Data -Building 1 Accounts.xlsx
Building 1 Graph

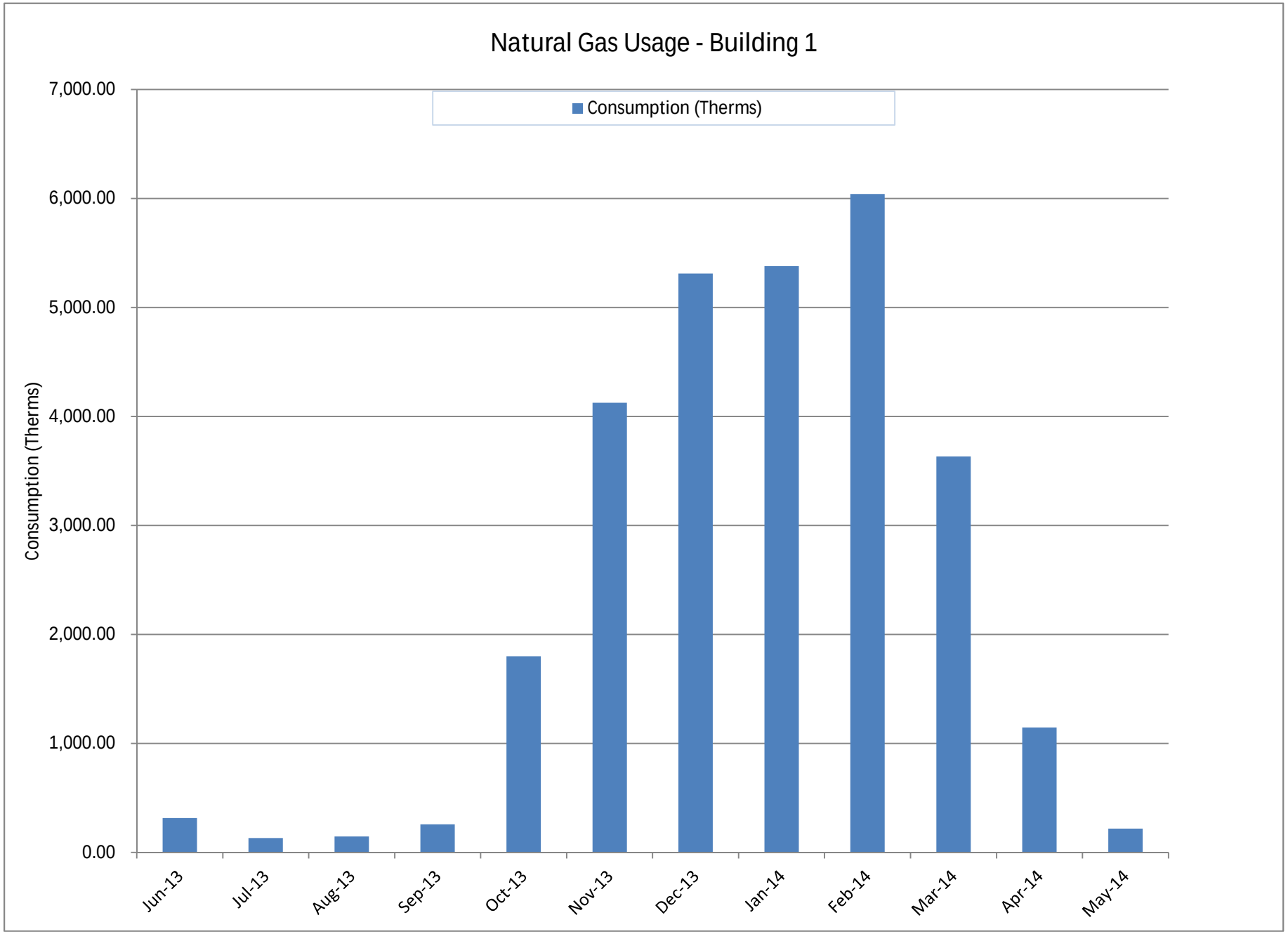
Building 1 Account Data
400 East Main Street, Denville, NJ 07834

For Service at: **400 East Main Street, Denville, NJ 07834**
Account No.: **100000077717**
Meter No: **L86699237**
Natural Gas Service **Delivery -** **New Jersey Natural Gas**
Supplier - **New Jersey Natural Gas**

Building 1 Consumption

Building Area	45,945	SF
% of Total Area Served	48.4%	%

		Charges		Unit Costs	
Month	**Consumption (Therms)**	**Delivery ($)**	**Total ($)**	**Delivery ($/Therm)**	**Total ($/Therm)**
June-12	100.55	$ 268.19	$ 268.19	$ 2.667	$ 2.667
July-12	184.98	$ 687.41	$ 687.41	$ 3.716	$ 3.716
August-12	144.76	$ 441.08	$ 441.08	$ 3.047	$ 3.047
September-12	354.21	$ 603.10	$ 603.10	$ 1.703	$ 1.703
October-12	1,196.75	$ 1,356.07	$ 1,356.07	$ 1.133	$ 1.133
November-12	4,723.92	$ 4,628.73	$ 4,628.73	$ 0.980	$ 0.980
December-12	4,487.91	$ 4,493.27	$ 4,493.27	$ 1.001	$ 1.001
January-13	4,535.43	$ 4,480.70	$ 4,480.70	$ 0.988	$ 0.988
February-13	4,052.06	$ 4,004.44	$ 4,004.44	$ 0.988	$ 0.988
March-13	3,422.08	$ 3,442.17	$ 3,442.17	$ 1.006	$ 1.006
April-13	1,873.99	$ 2,113.52	$ 2,113.52	$ 1.128	$ 1.128
May-13	1,012.12	$ 1,323.86	$ 1,323.86	$ 1.308	$ 1.308
June-13	317.03	$ 634.40	$ 634.40	$ 2.001	$ 2.001
July-13	132.33	$ 448.68	$ 448.68	$ 3.391	$ 3.391
August-13	148.02	$ 460.31	$ 460.31	$ 3.110	$ 3.110
September-13	257.59	$ 566.19	$ 566.19	$ 2.198	$ 2.198
October-13	1,801.65	$ 2,021.23	$ 2,021.23	$ 1.122	$ 1.122
November-13	4,125.41	$ 4,241.09	$ 4,241.09	$ 1.028	$ 1.028
December-13	5,310.95	$ 5,352.35	$ 5,352.35	$ 1.008	$ 1.008
January-14	5,380.65	$ 5,499.71	$ 5,499.71	$ 1.022	$ 1.022
February-14	6,042.35	$ 6,235.68	$ 6,235.68	$ 1.032	$ 1.032
March-14	3,632.82	$ 4,364.73	$ 4,364.73	$ 1.201	$ 1.201
April-14	1,147.33	$ 1,733.80	$ 1,733.80	$ 1.511	$ 1.511
May-14	219.77	$ 559.26	$ 559.26	$ 2.545	$ 2.545
June-14	219.77	$ 559.26	$ 559.26	$ 2.545	$ 2.545
Total (12 Months)	**28,516**		**$ 32,117.41**		**$ 1.126**


Natural Gas Usage - Building 1
Consumption (Therms)
7,000.00
6,000.00
5,000.00
4,000.00
3,000.00
2,000.00
1,000.00
0.00
Consumption (Therms)
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	Current year	Years Old	NJ Protocols life expectancy
RTU-1	1	1	Carrier Weathermaster	48HJE008--531	2595G20630	Packaged DX RTU with Gas Heat	7.5 Tons/147.6 MBH/ 2,750 SCFM	10.1 EER/ 82%	Roof	Multi-Media Rm 105	1998	4		2014	16	20
RTU-2	1	1	Carrier Weathermaster	48HJE005--531	2495G20630	Packaged DX RTU with Gas Heat	4 Tons/93.15 MBH/ 1,600 SCFM	11.0 EER/ 82%	Roof	Room 104A	1998	4		2014	16	20
RTU-3	1	1	Carrier Weathermaster	48HJE006--521	0995G20909	Packaged DX RTU with Gas Heat	5 Tons/93.15 MBH/ 2,000 SCFM	10.5 EER/ 82%	Roof	Room 104	1998	4		2014	16	20
RTU-4	1	1	Carrier Weathermaster	48HJE006--521	0995G20910	Packaged DX RTU with Gas Heat	5 Tons/93.15 MBH/ 2,000 SCFM	10.5 EER/ 82%	Roof	Networking & Info Tech Rm 106	1998	4		2014	16	20
RTU-5	1	1	Carrier Weathermaster	48HJE006--521	0995G20908	Packaged DX RTU with Gas Heat	5 Tons/93.15 MBH/ 2,000 SCFM	10.5 EER/ 82%	Roof	Digital Design Rm 107	1998	4		2014	16	20
RTU-6	1	1	Carrier Weathermaster	48HJE008--531	2595G30735	Packaged DX RTU with Gas Heat	7.5 Tons/147.6 MBH/ 2,750 SCFM	10.1 EER/ 82%	Roof	Finance & Business Rm 108	1998	4		2014	16	20
RTU-7	1	1	Carrier Weathermaster	48HJE004--521	4993G01567	Packaged DX RTU with Gas Heat	3 Tons/59.94 MBH/ 1,200 SCFM	9.7 EER/ 82%	Roof	Retail Supermarket Rm 109	1996	2		2014	18	20
RTU-8	1	1	Carrier Weathermaster	48HJE008--531	2595G30742	Packaged DX RTU with Gas Heat	7.5 Tons/147.6 MBH/ 2,750 SCFM	10.1 EER/ 82%	Roof	Retail Supermarket Rm 109	1998	4		2014	16	20
RTU-1	1	1	Lennox	LGA060H2BT2Y	5606E04735	Packaged DX RTU with Gas Heat	5 Tons/100.0 MBH/ 2,000 SCFM	10.3 EER/ 80%	Roof	Cosmetology Rm 102	1999	5		2014	15	20
RTU-2	1	1	Lennox	Nameplate Data Missing	Nameplate Data Missing	Packaged DX RTU with Gas Heat	6 Tons/100.0 MBH/ 2,400 SCFM	10.3 EER/ 80%	Roof	Cosmetology Rm 101	1999	5		2014	15	20
RTU-2A	1	1	Lennox	LGC072S4BH1Y	5606F14257	Packaged DX RTU with Gas Heat	6 Tons/100.0 MBH/ 2,400 SCFM	10.3 EER/ 80%	Roof	Director of Instructional Support	1999	5		2014	15	20
RTU-3	1	1	Lennox	LGA036H2BS2Y	5606E04483	Packaged DX RTU with Gas Heat	3 Tons/61.6 MBH/ 1,200 SCFM	10.5 EER/ 80%	Roof	CADD Rm 102A	1999	5		2014	15	20
RTU-4	1	1	Lennox	Nameplate Data Missing	Nameplate Data Missing	Packaged DX RTU with Gas Heat	5 Tons/100.0 MBH/ 2,000 SCFM	10.3 EER/ 80%	Roof	Cosmetology Rm 103	1999	5		2014	15	20
RTU-5	1	1	Lennox	LGC072S4BH1Y	5606F14256	Packaged DX RTU with Gas Heat	6 Tons/100.0 MBH/ 2,400 SCFM	10.3 EER/ 80%	Roof	Attendance/Superintendant Off	1999	5		2014	15	20
RTU-1	1	1	Trane	YCH092A3RMA13G	337101906L	Packaged DX RTU with Gas Heat	7.5 Tons/ 150 MBH	11 EER/ 80%	Roof	Main Office		-1994		2014	2014	20
HRU-1	1	1	Addison	DC360M033	940304201001	Packaged DX HRU with Gas Heat & Desiccant Wheel	30 Tons/562.5 MBH/ 12,000 SCFM	10.7 EER/ 80%	Roof	Cafeteria	2004	10		2014	10	20
HRU-2	1	1	Addison	DC048G096	C40304202001	Packaged DX HRU with Gas Heat & Desiccant Wheel	4 Tons/75.0 MBH/ 1,600 SCFM	21.6 EER/ 80%	Roof	Faculty Dining	2004	10		2014	10	20
HRU-3	1	1	Des Champs	PV-MZP-8703	47116	Packaged DX HRU with Gas Heat & Plate Heat Exchanger	15 Tons/160.0 MBH/ 3,100 SCFM	12.1 EER/ 80%	Roof	Gym/Locker Rooms	2003	9		2014	11	20
RTU-4	1	1	Lennox	LGA060H2BT2Y	5604D04810	Packaged DX RTU with Gas Heat	5 Tons/100.0 MBH/ 2,000 SCFM	10.3 EER/ 80%	Roof	Food Service	1999	5		2014	15	20
RTU-10A	1	1	Trane	YCD061C3LABE	N25100623D	Packaged DX RTU with Gas Heat	5 Tons/120.0 MBH	10.0 EER/ 80%	Roof	Athletic Director & Surrounding	1998	4		2014	16	20
RTU-11	1	1	Trane	YCC018FILOBE	N272TPP2H	Packaged DX RTU with Gas Heat	1.5 Tons/50 MBH	9.3 EER/ 78%	Roof	Business Administrator's Office	1998	4		2014	16	20
RTU-11A	1	1	Trane	TCD048C30ABC	N1310703D	DX Cooling Only RTU	4 Tons	10 EER	Roof	Finance & Business Rm 108	1998	4		2014	16	20
ACCU-1	1	1	Friedrich	MR09C1F	LFHC00546	Ductless Split System AC/Electric	9,700 btu/h	12 EER	Roof	Networking & Info Tech Rm 106	1998	-1		2014	16	15
ACCU-2	1	1	Mitsubishi	PU18EK	Not Available	Ductless Split System AC/Electric	1.5 Tons	12 EER	Roof	Director of Instructional Support	1998	-1		2014	16	15
ACCU-3	1	1	Mitsubishi	Mr Slim PU42EK72	Not Available	Ductless Split System AC/Electric	3.5 Tons	12 EER	Roof	Dance Studio	1998	-1		2014	16	15
ACCU-4	1	1	Mitsubishi	Mr Slim PU42EK72	Not Available	Ductless Split System AC/Electric	3.5 Tons	12 EER	Roof	Dance Studio	1998	-1		2014	16	15
ACCU-5	1	1	Mitsubishi	Mr Slim PU42EK72	Not Available	Ductless Split System AC/Electric	3.5 Tons	12 EER	Roof	Theater Arts Room	1998	-1		2014	16	15
ACCU-6	1	1	Mitsubishi	Mr Slim PU42EK72	Not Available	Ductless Split System AC/Electric	3.5 Tons	12 EER	Roof	Theater Arts Room	1998	-1		2014	16	15
ACCU-7	1	1	Mitsubishi	Mr Slim PU42EK72	Not Available	Ductless Split System AC/Electric	3.5 Tons	12 EER	Roof	Theater Arts Room	1998	-1		2014	16	15
DHW Boiler	1	1	AO Smith Burkay	BC420-872	872H9010369	Natural Gas-Fired DHW Boiler	543.8 MBH Output	82% Combustion	Old Boiler Rm	Building toilets, sinks & locker room showers	1998	9		2014	16	25
DHW Storage Tank	1	1	Nameplate Data Missing	Nameplate Data Missing	Nameplate Data Missing	DHW Storage	400 Gallon	NA	Old Boiler Rm	Building toilets, sinks & locker room showers	1998	9		2014	16	25
Electric UH	1	1	Trane	UHEC-072AACA	Not Available	Unit Heater/ Electric	7.5 kW	100%	Rear Storage	Rear Athletic Storage	1998	-1		2014	16	15
Electric UH	1	1	Dayton	2YU61	Not Available	Unit Heater/ Electric	3 kW	100%	Rear Storage	Rear Food Storage	1998	-1		2014	16	15
Range	1	4	Vulcan	GH45	481159458	Cooking Range/ Natural Gas	50,000 btu/h input	NA	Kitchen	Cooking	1998	-1		2014	16	15
Flat Top Range	1	1	Vulcan	GH60T	481159453	Cooking Range/ Natural Gas	50,000 btu/h input	NA	Kitchen	Cooking	1998	-1		2014	16	15
Broiler	1	1	Vulcan	GHCB34S	481159107	Cooking Broiler/ Natural Gas	50,000 btu/h input	NA	Kitchen	Cooking	1998	-1		2014	16	15
Dishwasher Booster Heater	1	1	Hatco	C-15	9875310012	Booster Heater/ Electric	15 kW	NA	Kitchen	Dishwasher	1998	-1		2014	16	15
Fryer	1	2	Vulcan	Nameplate Data Missing	Nameplate Data Missing	Fryer/ Electric	Nameplate Data Missing	NA	Kitchen	Cooking	1998	-1		2014	16	15
Warming Oven	1	1	General Electric	CB40B	102709G002	Oven / Electric	12 kW	NA	Kitchen	Cooking	1998	-1		2014	16	15
Warming Oven	1	2	Vulcan	Nameplate Data Missing	Nameplate Data Missing	Oven / Electric	Nameplate Data Missing	NA	Kitchen	Cooking	1998	-1		2014	16	15
Reach-In Freezer	1	3	Locked	Locked	Locked	Freezer/ Electric	Locked	NA	Kitchen	Food Storage	1998	-1		2014	16	15
Reach-In Refrigerator	1	6	Locked	Locked	Locked	Refrigerator/ Electric	Locked	NA	Kitchen	Food Storage	1998	-1		2014	16	15
Heated Display Case	1	2	Servolift Eastern	PHF-4	05/05-240268-7	Heated Display/ Electric	3.625 kW	NA	Cafeteria	Food Display	1998	-1		2014	16	15
Refrigerated Display Case	1	2	Servolift Eastern	PCF-5RAF	05/05-240268-6	Refrigerated Display/ Electric	10.3 A	NA	Cafeteria	Food Display	1998	-1		2014	16	15
Reach-In Refrigerator	1	2	True Manufacturing Co.	TS-49	1-3825777	Refrigerator/ Electric	9.5 FLA	NA	Cafeteria	Food Storage	1998	-1		2014	16	15

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.55 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
117	Front Entrance	Hallways	2	CF 23	CFS23/1	23	0.05	Breaker	2280	105	NONE	
117	Front Entrance	Hallways	2	CF 23	CFS23/1	23	0.05	SW	2280	105	NONE	
117	Front Lobby	Hallways	2	CF 23	CFS23/1	23	0.05	SW	2280	105	NONE	
54LED	Front Lobby	Hallways	12	B 34 C F 2 (MAG)	F42EE	72	0.86	SW	2280	1,970	NONE	
54LED	Front Main Hallway	Hallways	18	B 34 C F 2 (MAG)	F42EE	72	1.30	SW	2280	2,955	NONE	
218LED	101 Cosmetology	Classrooms	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.90	SW	3200	2,880	C-OCC	
218LED	101 Cosmetology	Classrooms	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.90	SW	3200	2,880	C-OCC	
6LED	101 Cosmetology Locker Room	Classrooms	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3200	736	C-OCC	
6LED	Attendance/Receptionist	Offices	4	T 34 R F 3 (MAG)	F43EE	115	0.46	SW	3120	1,435	NONE	
54LED	Superintendant's Office	Offices	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3120	449	NONE	
35LED	Superintendant's Secretary	Offices	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.45	SW	3120	1,404	C-OCC	
35LED	Superintendant's Office	Offices	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.36	SW	3120	1,123	C-OCC	
55LED	Superintendant's Office	Offices	2	2T 17 R F 3 (ELE)	F23ILL	47	0.09	SW	3120	293	C-OCC	
6LED	Superintendant's Office Confidential Closet	Offices	1	T 34 R F 3 (MAG)	F43EE	115	0.12	SW	3120	359	NONE	
55LED	Board Conference Room	Offices	8	2T 17 R F 3 (ELE)	F23ILL	47	0.38	SW	3120	1,173	C-OCC	
35LED	103 Board Office	Offices	10	T 32 R F 3 (ELE)	F43ILL/2	90	0.90	SW	3120	2,808	NONE	
35LED	103 Board Office	Offices	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.54	SW	3120	1,685	C-OCC	
55LED	103 Board Office	Offices	1	2T 17 R F 3 (ELE)	F23ILL	47	0.05	SW	3120	147	NONE	
6LED	103 Board Office	Offices	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3120	718	NONE	
35LED	Payroll Office	Offices	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.36	SW	3120	1,123	NONE	
218LED	102 Cosmetology	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
218LED	102 Cosmetology	Classrooms	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.72	SW	3200	2,304	C-OCC	
6LED	102 Cosmetology Locker Room	Classrooms	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3200	736	C-OCC	
28	Mens Restroom	Restroom	5	CR 32 C F 1	FC12/1	31	0.16	SW	1000	155	NONE	
54LED	Mens Restroom	Restroom	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	1000	288	NONE	
117	Janitor's Closet	Storage Areas	1	CF 23	CFS23/1	23	0.02	SW	1000	23	NONE	
218LED	Admission Curriculum & Programs Office	Offices	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.36	SW	3120	1,123	C-OCC	
218LED	DISS Office	Offices	2	W 32 P F 3 (ELE)	F43ILL/2	90	0.18	SW	3120	562	C-OCC	
218LED	DISS Office	Offices	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.09	SW	3120	281	C-OCC	
6LED	Grants Office	Offices	3	T 34 R F 3 (MAG)	F43EE	115	0.35	SW	3120	1,076	C-OCC	
35LED	104A Computer Lab	Classrooms	9	T 32 R F 3 (ELE)	F43ILL/2	90	0.81	SW	3200	2,592	C-OCC	
35LED	108 Finance & Business Academy	Classrooms	16	T 32 R F 3 (ELE)	F43ILL/2	90	1.44	SW	3200	4,608	C-OCC	
6LED	108 Data Room 1	Classrooms	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3200	736	C-OCC	
6LED	108 Data Room 2	Classrooms	3	T 34 R F 3 (MAG)	F43EE	115	0.35	SW	3200	1,104	C-OCC	
35LED	105 Multimedia	Classrooms	18	T 32 R F 3 (ELE)	F43ILL/2	90	1.62	SW	3200	5,184	C-OCC	
6LED	107 Digital Design	Classrooms	6	T 34 R F 3 (MAG)	F43EE	115	0.69	SW	3200	2,208	C-OCC	
6LED	107 Digital Design	Classrooms	6	T 34 R F 3 (MAG)	F43EE	115	0.69	SW	3200	2,208	C-OCC	
6LED	106 Network & Info Tech	Classrooms	6	T 34 R F 3 (MAG)	F43EE	115	0.69	SW	3200	2,208	C-OCC	
6LED	106 Network & Info Tech	Classrooms	6	T 34 R F 3 (MAG)	F43EE	115	0.69	SW	3200	2,208	C-OCC	
6LED	104 Classroom	Classrooms	7	T 34 R F 3 (MAG)	F43EE	115	0.81	SW	3200	2,576	C-OCC	
6LED	104 Classroom	Classrooms	7	T 34 R F 3 (MAG)	F43EE	115	0.81	SW	3200	2,576	C-OCC	
6LED	104 Classroom	Classrooms	7	T 34 R F 3 (MAG)	F43EE	115	0.81	SW	3200	2,576	C-OCC	
54LED	Café/Main Office Hallway	Hallways	22	B 34 C F 2 (MAG)	F42EE	72	1.58	SW	2280	3,612	NONE	
28	Womens Restroom	Restroom	5	CR 32 C F 1	FC12/1	31	0.16	SW	1000	155	NONE	
54LED	Womens Restroom	Restroom	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	1000	288	NONE	
6LED	Faculty Mens Restroom	Restroom	1	T 34 R F 3 (MAG)	F43EE	115	0.12	SW	1000	115	NONE	
117	Janitor's Closet	Storage Areas	2	CF 23	CFS23/1	23	0.05	SW	1000	46	NONE	
54LED	Central Hallway	Hallways	5	B 34 C F 2 (MAG)	F42EE	72	0.36	SW	2280	821	NONE	
218LED	103 Cosmetology	Classrooms	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.72	SW	3200	2,304	C-OCC	
218LED	103 Cosmetology	Classrooms	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.90	SW	3200	2,880	C-OCC	
6LED	103 Cosmetology	Classrooms	1	T 34 R F 3 (MAG)	F43EE	115	0.12	SW	3200	368	C-OCC	
6LED	103 Cosmetology	Classrooms	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3200	736	C-OCC	
6LED	Director of Athletics & Discipline	Offices	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3120	718	C-OCC	
6LED	Director of Athletics & Discipline	Offices	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3120	718	C-OCC	
6LED	Director of Athletics & Discipline	Offices	2	T 34 R F 3 (MAG)	F43EE	115	0.23	SW	3120	718	C-OCC	
6LED	Copy Room	Offices	4	T 34 R F 3 (MAG)	F43EE	115	0.46	SW	3120	1,435	NONE	
218LED	102A Computer Room	Classrooms	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.72	SW	3200	2,304	C-OCC	
218LED	102A Computer Room	Classrooms	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.36	SW	3200	1,152	C-OCC	
117	102A Computer Room	Classrooms	1	CF 23	CFS23/1	23	0.02	SW	3200	74	C-OCC	
6LED	Faculty Womens Restroom	Restroom	1	T 34 R F 3 (MAG)	F43EE	115	0.12	SW	1000	115	NONE	
35LED	109 Retail Supermarket	Classrooms	26	T 32 R F 3 (ELE)	F43ILL/2	90	2.34	SW	3200	7,488	C-OCC	
40LED	Central Hallway	Hallways	10	T 32 R F 2 (ELE)	F42LL	60	0.60	SW	2280	1,368	NONE	
40LED	Mens Restroom	Restroom	3	T 32 R F 2 (ELE)	F42LL	60	0.18	SW	1000	180	NONE	
40LED	Womens Restroom	Restroom	3	T 32 R F 2 (ELE)	F42LL	60	0.18	SW	1000	180	NONE	
40LED	Electric Room	Mechanical Room	4	T 32 R F 2 (ELE)	F42LL	60	0.24	SW	1000	240	NONE	
218LED	ETTC Computer Lab	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
218LED	ETTC Computer Lab	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
64LED	Old Boiler Room/Storage	Mechanical Room	6	175 MV	MV175/1	205	1.23	SW	1000	1,230	NONE	
35LED	Dance Studio	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	NONE	
254LED	Dance Studio	Classrooms	6	CFQ26/2	CFQ26/2	66	0.40	SW	3200	1,267	NONE	
265LED	Dance Studio	EDIT THIS FIXT CODE	1	Gym HB 8L CFL	CF42/8-L	376	0.38	SW	8760	3,294	NONE	

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.55 **$/kW**

			EXISTING CONDITIONS								Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
35LED	Dance Studio	Classrooms	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	3200	288	NONE	
252LED	Dance Studio	Classrooms	6	B 32 C F 6 (ELE)	F46LL	182	1.09	SW	3200	3,494	NONE	
252LED	Theater Arts	Classrooms	9	B 32 C F 6 (ELE)	F46LL	182	1.64	SW	3200	5,242	NONE	
265LED	Gymnasium	Classrooms	9	Gym HB 8L CFL	CF42/8-L	376	3.38	SW	3200	10,829	NONE	
265LED	Gymnasium	Classrooms	11	Gym HB 8L CFL	CF42/8-L	376	4.14	SW	3200	13,235	NONE	
265LED	Gymnasium	Classrooms	4	Gym HB 8L CFL	CF42/8-L	376	1.50	SW	3200	4,813	NONE	
274LED	Fitness Center	Classrooms	20	2T CFB 40/5	CFT40/5-BX	190	3.80	SW	3200	12,160	NONE	
40LED	Rear Locker Room Hallway	Hallways	5	T 32 R F 2 (ELE)	F42LL	60	0.30	SW	2280	684	NONE	
35LED	Mens Locker Room	Restroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	1000	180	NONE	
41LED	Mens Locker Room	Restroom	1	W 40 R F 2 (MAG)	F42SS	94	0.09	SW	1000	94	NONE	
40LED	Mens Locker Room	Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.12	SW	1000	120	NONE	
40LED	Mens Locker Room Restroom	Restroom	5	T 32 R F 2 (ELE)	F42LL	60	0.30	SW	1000	300	NONE	
40LED	Faculty Mens Restroom	Restroom	3	T 32 R F 2 (ELE)	F42LL	60	0.18	SW	1000	180	NONE	
35LED	Womens Locker Room	Restroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	1000	180	NONE	
41LED	Womens Locker Room	Restroom	1	W 40 R F 2 (MAG)	F42SS	94	0.09	SW	1000	94	NONE	
40LED	Womens Locker Room	Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.12	SW	1000	120	NONE	
40LED	Womens Locker Room Restroom	Restroom	5	T 32 R F 2 (ELE)	F42LL	60	0.30	SW	1000	300	NONE	
40LED	Faculty Womens Restroom	Restroom	3	T 32 R F 2 (ELE)	F42LL	60	0.18	SW	1000	180	NONE	
41LED	Rear Gym Storage	Storage Areas	4	W 40 R F 2 (MAG)	F42SS	94	0.38	SW	1000	376	NONE	
218LED	113 Staff Dining	Classrooms	14	W 32 P F 3 (ELE)	F43ILL/2	90	1.26	SW	3200	4,032	C-OCC	
254LED	113 Staff Dining	Classrooms	3	CFQ26/2	CFQ26/2	66	0.20	SW	3200	634	C-OCC	
218LED	Dining Hall	Classrooms	28	W 32 P F 3 (ELE)	F43ILL/2	90	2.52	SW	3200	8,064	C-OCC	
218LED	Dining Hall	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
254LED	Dining Hall	Classrooms	18	CFQ26/2	CFQ26/2	66	1.19	SW	3200	3,802	C-OCC	
218LED	Dining Hall	Classrooms	36	W 32 P F 3 (ELE)	F43ILL/2	90	3.24	SW	3200	10,368	C-OCC	
40LED	Dining Hall	Classrooms	5	T 32 R F 2 (ELE)	F42LL	60	0.30	SW	3200	960	C-OCC	
18LED	Dining Rear Corridor	Hallways	2	T 32 R F 4 (ELE)	F44ILL	112	0.22	SW	2280	511	NONE	
35LED	Rear Food Storage	Storage Areas	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	1000	90	NONE	
6LED	Kitchen	Offices	5	T 34 R F 3 (MAG)	F43EE	115	0.58	SW	3120	1,794	C-OCC	
6LED	Kitchen	Offices	5	T 34 R F 3 (MAG)	F43EE	115	0.58	SW	3120	1,794	C-OCC	
6LED	Kitchen	Offices	4	T 34 R F 3 (MAG)	F43EE	115	0.46	SW	3120	1,435	C-OCC	
6LED	Kitchen	Offices	7	T 34 R F 3 (MAG)	F43EE	115	0.81	SW	3120	2,512	C-OCC	
6LED	Kitchen	Offices	1	T 34 R F 3 (MAG)	F43EE	115	0.12	SW	3120	359	C-OCC	
35LED	129 Food Service	Classrooms	13	T 32 R F 3 (ELE)	F43ILL/2	90	1.17	SW	3200	3,744	C-OCC	
6LED	129 Food Service	Classrooms	4	T 34 R F 3 (MAG)	F43EE	115	0.46	SW	3200	1,472	C-OCC	
55LED	Main Office	Offices	11	2T 17 R F 3 (ELE)	F23ILL	47	0.52	SW	3120	1,613	C-OCC	
254LED	Main Office	Offices	4	CFQ26/2	CFQ26/2	66	0.26	SW	3120	824	C-OCC	
41LED	Main Office	Offices	2	W 40 R F 2 (MAG)	F42SS	94	0.19	SW	3120	587	C-OCC	
35LED	Main Office	Offices	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	3120	281	C-OCC	
35LED	Principal's Office	Offices	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.36	SW	3120	1,123	C-OCC	
218LED	Main Office Conference Room	Offices	6	W 32 P F 3 (ELE)	F43ILL/2	90	0.54	SW	3120	1,685	C-OCC	
35LED	Student Activities & Discipline	Offices	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.27	SW	3120	842	C-OCC	
35LED	Main Office	Offices	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	3120	281	C-OCC	
35LED	Main Office	Offices	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	3120	281	C-OCC	
35LED	Programs Supervisor	Offices	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.36	SW	3120	1,123	C-OCC	
35LED	Main Office	Offices	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3120	562	C-OCC	
40LED	Main Office Mens Restroom	Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.06	SW	1000	60	NONE	
40LED	Main Office Womens Restroom	Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.06	SW	1000	60	NONE	
35LED	Gym Vending Area	Classrooms	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.09	SW	3200	288	C-OCC	

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: $0.090 $/kWh
$3.55 $/kW

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh			
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)		Retrofit control device	Notes

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide Equivalent	Building Area	Annual Utility Cost		
					Electric	Natural Gas	Fuel Oil
$ 0.120	$/kWh blended		0.000420205	45,945	$ 67,089	$ 32,117	$ -
$ 0.090	$/kWh supply	566,039	0.000420205				
$ 3.38	$/kW	194.0	0				
$ 1.13	$/Therm	28,516	0.00533471				
$ 9.00	$/kgals	10,000	0				
$ -	$/Gal	-					

Building 1

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO_2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Replace Windows	0.0	944	1,267	0	0	1,540	$ 258,554	167.9	20	7.2	$ -	N	167.9	0.0	18,875	25,345	0	$ 30,803	(0.9)	($235,640)	-15.1%
Y	ECM-2	Replace Door Seals	0.0	505	314	0	0	414	$ 2,305	5.6	10	1.9	$ -	N	5.6	0.0	5,046	3,141	0	$ 4,143	0.8	$1,229	12.4%
Y	ECM-3	Replace RTUs	28.3	47,742	1,625	0	0	7,273	$ 260,100	35.8	15	28.7	$ 8,146	N	34.6	424.2	716,129	24,369	0	$130,582	(0.5)	($165,127)	-9.0%
Y	ECM-4	Replace Electric Heat with Natural Gas	0.0	18,593	(634)	0	0	1,517	$ 18,000	11.9	15.0	4.4	$ -	N	11.9	0.0	278,901	(9,516)	0	$ 22,753	0.3	$108	3.1%
Y	ECM-5	Condensing DHW Boiler	0.0	0	765	0	0	861	$ 72,167	83.8	25.0	4.1	$ 700	N	83.0	0.0	0	19,115	0	$ 21,524	(0.7)	($56,476)	-7.7%
Y	ECM-6	Replace Electric Kitchen Equipment with Natural Gas	0.0	71,440	(2,438)	0	0	5,828	$ 147,816	25.4	15.0	17.0	$ 3,498	N	24.8	0.0	1,071,600	(36,563)	0	$ 87,422	(0.4)	($74,742)	-5.7%
Y	ECM-7	Replace Reach-In Refrigeration Units with Walk-In Units	0.0	21,316	0	0	0	2,558	$ 87,589	34.2	15.0	9.0	$ -	N	34.2	0.0	319,738	0	0	$ 38,369	(0.6)	($57,052)	-8.9%
Y	ECM-8	Kitchen Hood Controls	0.0	59,645	6,848	0	0	14,869	$ 39,678	2.7	15.0	61.6	$ 1,500	N	2.6	0.0	894,669	102,725	0	$223,029	4.6	$139,323	38.7%
Y	ECM-9	Dishwasher Booster Heater Conversion	7.0	23,447	(1,000)	0	0	1,269	$ 16,800	13.2	15.0	4.5	$ 3,500	N	10.5	105.5	351,700	(15,000)	0	$ 29,593	0.8	$1,855	4.9%
Y	ECM-10	Vending Machine Controls	0.0	13,960	0	0	0	1,675	$ 1,401	0.8	15.0	5.9	$ 150	N	0.7	0.0	209,402	0	0	$ 25,128	16.9	$18,748	134.0%
Y	ECM-11	Computer Network Controller	0.0	12,950	0	0	0	1,554	$ 1,776	1.1	15.0	5.4	$ -	N	1.1	0.0	194,250	0	0	$ 23,310	12.12662	$16,776	87.5%
Y	ECM-12	Install Low Flow Plumbing Fixtures	0.0	0	375	0	92	1,246	$ 60,495	48.6	30.0	2.0	$ -	N	48.6	0.0	0	11,246	2,746	$ 37,372	(0.4)	($36,078)	-2.9%
N	ECM-L1	Lighting Replacements / Upgrades	40.7	124,163	0	0	0	12,825	$ 224,832	17.5	15.0	52.2	$ 38,035	N	14.6	610.5	1,862,445	0	0	$248,255	0.1	($33,687)	0.4%
N	ECM-L2	Install Lighting Controls (Add Occupancy Sensors)	0.0	39,834	0	0	0	4,780	$ 17,820	3.7	15.0	16.7	$ 2,310	N	3.2	0.0	597,510	0	0	$ 71,701	3.0	$41,554	30.2%
Y	ECM-L3	Lighting Replacements with Controls (Occupancy Sensors)	40.7	141,929	0	0	0	14,424	$ 242,652	16.8	15.0	59.6	$ 40,345	N	14.0	610.5	2,128,935	0	0	$280,234	0.2	($30,109)	0.9%
		Total (Not Including [B] Option ECMs or L1, L2)	**76.0**	**412,470**	**7,122**	**0**	**92**	**$ 55,029**	**$ 1,209,331**	**22.0**	**16.9**	**211**	**$ 57,839**		**20.9**	**1,140**	**6,189,245**	**124,862**	**2,746**	**$954,261**	**(0.2)**	**($460,268)**	**-3.0%**
		Recommended Measures (highlighted green above)	**76.0**	**412,470**	**7,122**	**0**	**92**	**$ 55,029**	**$ 1,209,331**	**22.0**	**16.9**	**211**	**$ 57,839**	**0**	**20.9**	**1,140**	**6,189,245**	**124,862**	**2,746**	**$954,261**	**(0.2)**	**($460,268)**	**-3.0%**
		% of Existing	**39%**	**72.87%**	**24.97%**	**0**	**0.0091517**																

	City:	Newark, NJ				
	Occupied Hours/Week	75	75	75	75	50
		Building Operating Hours	Auditorium Occupied Hours	Gymnasium Occupied Hours	Library Occupied Hours	Classrooms Occupied Hours
Temp	Enthalpy h (Btu/lb)	Bin Hours				
102.5						
97.5	35.4	6	3	3	3	3	2
92.5	37.4	31	14	14	14	14	9
87.5	35.0	131	58	58	58	58	39
82.5	33.0	500	223	223	223	223	149
77.5	31.5	620	277	277	277	277	185
72.5	29.9	664	296	296	296	296	198
67.5	27.2	854	381	381	381	381	254
62.5	24.0	927	414	414	414	414	276
57.5	20.3	600	268	268	268	268	179
52.5	18.2	730	326	326	326	326	217
47.5	16.0	491	219	219	219	219	146
42.5	14.5	656	293	293	293	293	195
37.5	12.5	1,023	457	457	457	457	304
32.5	10.5	734	328	328	328	328	218
27.5	8.7	334	149	149	149	149	99
22.5	7.0	252	113	113	113	113	75
17.5	5.4	125	56	56	56	56	37
12.5	3.7	47	21	21	21	21	14
7.5	2.1	34	15	15	15	15	10
2.5	1.3	1	0	0	0	0	0
-2.5							
-7.5							

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

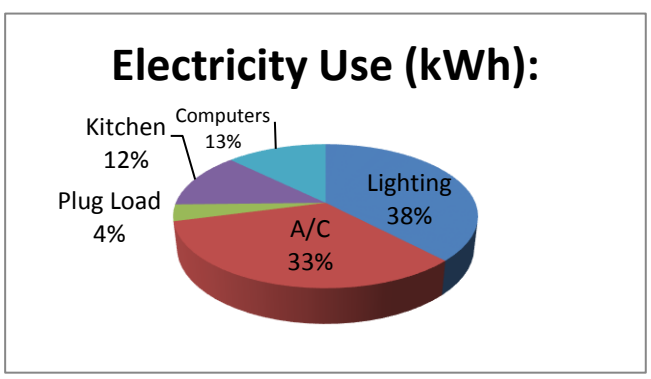
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

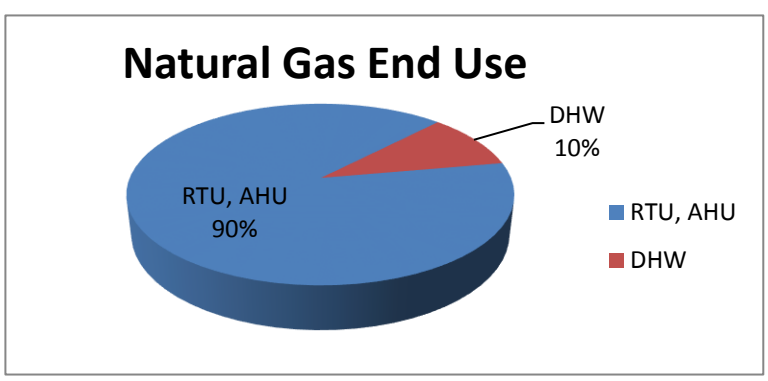
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
566,039	Total	Based on utility analysis	
214,036	Lighting	From Lighting Calculations	0.378129422
187,046	A/C	See Window AC Calculation	0.330446508
21,023	Plug Load	Estimated	0.037140992
71,440	Kitchen	Estimated	0.126210385
72,000	Computers	Estimated	0.127199716
Natural Gas Use (Therms):		**Notes/Comments:**	
28,516	Total	Based on utility analysis	
25,664	RTU, AHU	Based on utility analysis	0.9
2,852	DHW	Based on utility analysis	0.1





Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Note: pricing is for energy calculations only -do not use for procurement

ECM-1: Window Replacement

Existing: Windows are not properly sealed and have a high heat gain/loss rate (U Value). This can lead to increased energy consumption due to infiltration/exfiltration and heat gain/loss.
Proposed: Replace single pane windows with new double pane windows to reduce heat gain/loss and infiltration/exfiltration

Linear Feet of window Edge	1,360.0	LF	Cooling System Efficiency	1.2	kW/ton	Heating System Efficiency	80%	
Area of window glass	1,400.0	SF	Ex Occupied Clng Temp.	72	*F	Heating On Temp.	60	*F
Existing Infiltration Factor	**0.25**	**cfm/LF**	Ex Unoccupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Proposed Infiltration Factor	**0.10**	**cfm/LF**	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Ex Unoccupied Htg Temp.	72	*F
Existing U Value	**0.68**	**Btuh/SF/°F**	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.120	$/kWh
Proposed U Value	**0.45**	**Btuh/SF/°F**				Natural Gas	$ 1.13	$/therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	50.1	0	0	0	-63,614	-63,614	-33,046	-33,046	0	0	0	0
97.5	42.5	6	2	4	-47,226	-47,226	-25,245	-25,245	28	15	0	0
92.5	39.5	45	16	29	-37,876	-37,876	-20,259	-20,259	171	91	0	0
87.5	36.6	146	52	94	-28,679	-28,679	-15,334	-15,334	419	224	0	0
82.5	34.0	298	106	192	-19,941	-19,941	-10,593	-10,593	595	316	0	0
77.5	31.6	476	170	306	-11,509	-11,509	-5,974	-5,974	548	285	0	0
72.5	29.2	662	237	426	-3,077	-3,077	-1,355	-1,355	204	90	0	0
67.5	27.0	740	264	476	0	0	0	0	0	0	0	0
62.5	24.5	765	273	492	0	0	0	0	0	0	0	0
57.5	21.4	733	262	471	19,128	19,128	11,265	11,265	0	0	175	103
52.5	18.7	668	239	430	25,724	25,724	15,149	15,149	0	0	215	127
47.5	16.2	659	235	424	32,320	32,320	19,034	19,034	0	0	266	157
42.5	14.4	685	245	441	38,916	38,916	22,918	22,918	0	0	333	196
37.5	12.6	739	264	475	45,512	45,512	26,802	26,802	0	0	421	248
32.5	10.7	717	256	461	52,108	52,108	30,687	30,687	0	0	467	275
27.5	8.6	543	194	349	58,704	58,704	34,571	34,571	0	0	399	235
22.5	6.8	318	114	205	65,300	65,300	38,456	38,456	0	0	260	153
17.5	5.5	245	88	158	71,896	71,896	42,340	42,340	0	0	220	130
12.5	4.1	156	56	100	78,492	78,492	46,224	46,224	0	0	153	90
7.5	2.6	92	33	59	85,088	85,088	50,109	50,109	0	0	98	58
2.5	1.0	36	13	23	91,684	91,684	53,993	53,993	0	0	41	24
-2.5	0.0	19	7	12	98,280	98,280	57,878	57,878	0	0	23	14
-7.5	-1.5	8	3	5	104,876	104,876	61,762	61,762	0	0	10	6
TOTALS		**8,760**	**3,129**	**5,631**					1964	1020	**3,083**	**1,815**

Existing Window Infiltration	**340**	**cfm**
Existing Window Heat Transfer	**952**	**Btuh/°F**
Proposed Window Infiltration	**136**	**cfm**
Proposed Window Heat Transfer	**630**	**Btuh/°F**

Savings				
	1,267	**Therms**	**$**	**1,427**
	944	**kWh**	**$**	**113**
			$	**1,540**

Window ID	Location	Quantity	Width (ft)	Height (ft)	Linear Feet (LF)	Area (SF)	Infiltration Rate (CFM/LF)	U Value (Btuh/SF/°F)	Infiltration (CFM)	Heat Transfer (Btuh/°F)
1	Exterior Wall	80	3.5	5	1360.0	1400.0	0.25	0.68	340.0	952.0
Total		**80**	**3.5**	**5**	**1,360.0**	**1,400.0**	**0.25**	**0.68**	**340.0**	**952.0**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Window Replacement - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
New Windows	1400	SF	$ 65	$ 65	$ -	$ 93,457	$ 113,386	$ -	$ 206,843	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 206,843	Subtotal
$ 51,711	25% Contingency
$ 258,554	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-2: Install Door Seals

Description: This ECM evaluates the thermal and electrical savings associate with adding door seals and sweeps to prevent infiltration of cold (hot) outdoor air.

Heating System Efficiency	80%		Ex Occupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Cooling System Efficiency	1.20	kW/ton	Ex Unoccupied Clng Temp.	72	*F	Ex Unoccupied Htg Temp.	72	*F
Linear Feet of Door Edge	130	LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.12	$/kWh
Existing Infiltration Factor*	1.5	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.13	$/therm
Proposed Infiltration Factor*	0.45	cfm/LF						

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	0.0	0	0	0	24,131	24,131	7,239	7,239	0	0	0	0
97.5	35.4	6	3	3	-6,939	-6,939	-2,082	-2,082	4	1	0	0
92.5	37.4	31	14	17	-8,689	-8,689	-2,607	-2,607	27	8	0	0
87.5	35.0	131	58	73	-6,568	-6,568	-1,970	-1,970	86	26	0	0
82.5	33.0	500	223	277	-4,868	-4,868	-1,460	-1,460	243	73	0	0
77.5	31.5	620	277	343	-3,552	-3,552	-1,066	-1,066	220	66	0	0
72.5	29.9	664	296	368	-2,111	-2,111	-633	-633	140	42	0	0
67.5	27.2	854	381	473	948	948	284	284	0	0	10	3
62.5	24.0	927	414	513	2,001	2,001	600	600	0	0	23	7
57.5	20.3	600	268	332	3,054	3,054	916	916	0	0	23	7
52.5	18.2	730	326	404	4,107	4,107	1,232	1,232	0	0	37	11
47.5	16.0	491	219	272	5,160	5,160	1,548	1,548	0	0	32	10
42.5	14.5	656	293	363	6,213	6,213	1,864	1,864	0	0	51	15
37.5	12.5	1,023	457	566	7,266	7,266	2,180	2,180	0	0	93	28
32.5	10.5	734	328	406	8,319	8,319	2,496	2,496	0	0	76	23
27.5	8.7	334	149	185	9,372	9,372	2,812	2,812	0	0	39	12
22.5	7.0	252	113	140	10,425	10,425	3,127	3,127	0	0	33	10
17.5	5.4	125	56	69	11,478	11,478	3,443	3,443	0	0	18	5
12.5	3.7	47	21	26	12,531	12,531	3,759	3,759	0	0	7	2
7.5	2.1	34	15	19	13,584	13,584	4,075	4,075	0	0	6	2
2.5	1.3	1	0	1	14,637	14,637	4,391	4,391	0	0	0	0
-2.5	0.0	0	0	0	15,690	15,690	4,707	4,707	0	0	0	0
-7.5	0.0	0	0	0	16,743	16,743	5,023	5,023	0	0	0	0
TOTALS		**8,760**	**3,911**	**4,849**					**721**	**216**	**449**	**135**

Existing Door Infiltration	**195**	**cfm**	**Savings**	**314**	**therms**	**$ 354**
Existing Unoccupied Door Infiltration	**195**	**cfm**		**505**	**kWh**	**$ 61**
Proposed Door Infiltration	**59**	**cfm**				**$ 414**
Proposed Unoccupied Door Infiltration	**59**	**cfm**				

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
1	3	7	20	0.125	all sides	13	65%	0.08125
2	3	7	20	0.125	all sides	13	65%	0.08125
3	3	7	20	0.125	all sides	13	65%	0.08125
4	3	7	20	0.125	all sides	13	65%	0.08125
5	3	7	20	0.125	all sides	13	65%	0.08125
6	3	7	20	0.125	all sides	13	65%	0.08125
7	3	7	20	0.125	all sides	13	65%	0.08125
8	3	7	20	0.125	all sides	13	65%	0.08125
9	3	7	20	0.125	all sides	13	65%	0.08125
10	3	7	20	0.125	all sides	13	65%	0.08125
Total	**30**	**70**	**200**	**0.125**		**130**	**65%**	**0.081**

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-2: Install Door Seals - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Weatherization Seals & Sweeps	10	EA	$ 40	$ 115	$ -	$ 411	$ 1,433	$ -	$ 1,844	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,844	Subtotal
$ 461	25% Contingency
$ 2,305	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-3: Replace RTUs With More Efficient RTUs

Description: This ECM evaluates the energy savings associated with replacing older less efficient heating and cooling equipment with modern high efficiency unitary equipment havings the same capacity

Equipment Tag	Equipment Description	General Type	Cooling Capacity (Btu/h)	Heating Capacity (Btu/h)
	Split System	HVAC	12,000	
RTU-1	RTU	HVAC	90,000	147,600
RTU-2	RTU	HVAC	48,000	93,150
RTU-3	RTU	HVAC	60,000	93,150
RTU-4	RTU	HVAC	60,000	93,150
RTU-5	RTU	HVAC	60,000	93,150
RTU-6	RTU	HVAC	90,000	147,600
RTU-7	RTU	HVAC	36,000	59,940
RTU-8	RTU	HVAC	90,000	147,600
RTU-1	RTU	HVAC	60,000	100,000
RTU-2	RTU	HVAC	72,000	100,000
RTU-2A	RTU	HVAC	72,000	100,000
RTU-3	RTU	HVAC	36,000	61,600
RTU-4	RTU	HVAC	60,000	100,000
RTU-5	RTU	HVAC	72,000	100,000
RTU-1	RTU	HVAC	90,000	150,000
RTU-4	RTU	HVAC	60,000	100,000
RTU-10A	RTU	HVAC	60,000	120,000
RTU-11	RTU	HVAC	18,000	50,000
RTU-11A	RTU	HVAC	48,000	-

Item	Value	Units	Formula/Comments	
Demand Rate	$ 3.38	/ kW		
Electricity Rate	$ 0.09	/kWh		
Natural Gas Rate	$ 1.13	/Therm		
FORMULA CONSTANTS				
Coincidence Factor	0.67		NJ Protocols	
Conversion	3.412	btu/kW		
COOLING - HVAC				
Cooling Capacity	1,194,000	btu/hr		btuh
Baseline EER	11.0		average existing efficiency	EERb
Proposed EER	18.0		Proposed equipment efficiency	EERq
Equivalent Full Load Hours	1,131	hrs	NJ Protocols	
Demand Savings	28.28	kW		
Energy Savings	47,742	kWh		
HEATING - HVAC				
Heating Capacity	1,856,940	btu/h		
Baseline Heating Efficiency	78%		Exisitng AFUE	
Proposed Heating Efficiency	80%		Proposed AFUE	
Equivalent Full Load Hours	800	hrs	NJ Protocols	
Heating Savings	1,624.58	Therms		
SAVINGS				
Demand Savings	28.28	kW		
Natural Gas Energy Savings	1,624.58	Therms		
Electric Energy Savings	47,742	kWh		
Cost Savings	$ 7,273			

Savings calculation formulas are taken from NJ Protocols document for Electric HVAC Equipment

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-3: Replace RTUs With More Efficient RTUs - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Existing (19) RTUs demolition	19	EA		$ 575		$ -	$ 13,613	$ -	$ 13,613	RS Means 2012
(4) RTUs, 7.5 ton packaged units	4	EA	$ 7,650	$ 1,625		$ 31,426	$ 8,099	$ -	$ 39,525	RS Means 2012
(3) RTUs, 6.0 ton packaged units	3	EA	$ 5,825	$ 1,550		$ 17,947	$ 5,794	$ -	$ 23,741	RS Means 2012
(7) RTUs, 5.0 ton packaged units	7	EA	$ 4,975	$ 1,425		$ 35,765	$ 12,429	$ -	$ 48,194	RS Means 2012
(2) RTUs, 4.0 ton packaged units	2	EA	$ 4,250	$ 1,325		$ 8,730	$ 3,302	$ -	$ 12,031	RS Means 2012
(3) RTUs, 3.0 ton packaged units	3	EA	$ 3,600	$ 1,150		$ 11,092	$ 4,299	$ -	$ 15,390	RS Means 2012
- Reprogram DDC system for (19) RTUs	19	EA	$ 75	$ 300		$ 1,463	$ 7,102	$ -	$ 8,566	RS Means 2012
Crane Rental	1	LS	$ -	$ -	$ 5,000	$ -	$ -	$ 5,620	$ 5,620	
Electrical - misc.	1	LS	$ 10,000	$ 25,000		$ 10,270	$ 31,150	$ -	$ 41,420	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 208,100	Subtotal
$ 52,025	25% Contingency
$ 260,100	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-4: Replace Electric Heat with Natural Gas

ECM Description Summary

The storage space adjacent to the back of the cafeteria is currently heated by (1) wall mounted electric unit heater and (1) recessed cabinet unit heater, each are approximately 3 kW.It is proposed to replace these electric heaters with equivalent sized natural gas-fired unit heaters to provide heating to the space. Cost savings will result from the lower unit cost of natural gas versus electricity.

Existing Fuel Electric
Proposed Fuel Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 0.12	/ kWh	from utility bill analysis
Proposed Fuel Cost	$ 1.13	/ Therm	from utility bill analysis
Electric Heating Equipment			
- Electric Unit Heater	3.0	kW	Based on equipment nameplate data
- Electric Cabinet Heater	3.0	kW	Based on equipment nameplate data
- Total Equipment kW	6.0	**kW**	
Annual Operating Hours	3,099	hours	Heating hours from bin weather data derated for cycling factor (70%)
Baseline Equipment Efficiency	100%		
Baseline Annual Electric Use	18,593	**kWh**	
Baseline Annual Electric Cost	$ 2,231		
Proposed Equipment Efficiency	80%		Approximation
Proposed Fuel Use	634	**Therms**	Baseline Electric Use x 3,412 BTU/kWh / 100,000 BTU/Therm
Proposed Fuel Cost	$ 714		
Annual Savings	$ 1,517		
Natural Gas Equipment Project Cost	$ -		
Simple Payback	0.0	Years	

*Note to engineer: Link savings back to summary sheet in appropriate column.

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-4: Replace Electric Heat with Natural Gas - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Existing (2) Heater Demolition	2	EA		$ 50		$ -	$ 125	$ -	$ 125	RS means 2012
(2) NG-Fired Unit Heaters	2	EA	$ 800	$ 150		$ 1,643	$ 374	$ -	$ 2,017	RS means 2012
- Reprogram DDC system for (2) UHs	2	EA	$ 75	$ 300		$ 154	$ 748	$ -	$ 902	RS means 2012
Natural Gas Piping	1	LS	$ 5,000	$ 5,000		$ 5,135	$ 6,230	$ -	$ 11,365	RS means 2012
						$ -	$ -	$ -	$ -	

$ 14,408	Subtotal
$ 3,602	25% Contingency
$ 18,000	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-5: Replace Gas-Fired DHW Boiler with Condensing DHW Boiler

Description: This ECM evaluates the energy savings associated with replacing the existing standard efficiency DHW boiler and storage tank with a new high efficiency condensing natural gas fired DHW boiler and new indirect storage tanks. Natural Gas savings will result from improved overall system efficiency.

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	**238**	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	285,160	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	72%		Based on age and appearance
Total Annual Hot Water Demand (w/ standby losses)	205,315	MBTU/yr	
Existing Tank Size	400	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	Per building personnel
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	5.7	MBH	
Annual Standby Hot Water Load	50,261	MBTU/yr	
New Tank Size	360	Gallons	PK Mach N Roll with storage tanks
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	5.2	MBH	
Annual Standby Hot Water Load	45,297	MBTU/yr	
Total Annual Hot Water Demand	200,351	MBTU/yr	
Proposed Avg. Hot water heater efficiency	96%		Based on new, condensing DHW Boiler
Proposed Fuel Use	2,087	Therns	Standby Losses and inefficient DHW heater eliminated
Utility Cost	$1.13	$/Therm	
Existing Operating Cost of DHW	$3,211	$/yr	
Proposed Operating Cost of DHW	$2,350	$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Therms/yr	765	$861

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-5: Replace Gas-Fired DHW Boiler with Condensing DHW Boiler - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Gas-Fired DHW Heater Removal	1	LS		$ 575		$ -	$ 716	$ -	$ 716	RS Means 2012
Condensing DHW Boiler (Mach N Roll)	1	EA	$ 25,000	$ 10,000		$ 25,675	$ 12,460	$ -	$ 38,135	Vendor Pricing
(3) 120 Gal DHW Storage Tanks	3	EA	$ 2,000	$ 1,000		$ 6,162	$ 3,738	$ -	$ 9,900	Vendor Pricing
Miscellaneous Electrical	1	EA	$ 500	$ 1,000		$ 514	$ 1,246	$ -	$ 1,760	RS Means 2012
Venting and combustion air	1	EA	$ 2,500	$ 1,500		$ 2,568	$ 1,869	$ -	$ 4,437	RS Means 2012
Miscellaneous Piping and Valves	1	LS	$ 1,500	$ 1,000		$ 1,541	$ 1,246	$ -	$ 2,787	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 57,734	Subtotal
$ 14,433	25% Contingency
$ 72,167	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-6: Replace Electric Kitchen Equipment with Natural Gas Equipment

ECM Description Summary

The kitchen contains electrically powered cooking and refrigeration equipment such as warming/convection ovens, and fryers. Electricity costs more than natural gas therefore it is worthwhile to consider replacing electric equipment with natural gas equipment. The assumption of this calculation is that the operating hours and electrical power consumption of the existing electrical equipment are replaced with equvalent natural gas fired equipment.

Existing Fuel Electric
Proposed Fuel Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 0.12	/ kWh	from utility bill analysis
Proposed Fuel Cost	$ 1.13	/ Therm	from utility bill analysis
Kitchen Equipment			
- Commercial Warming Ovens	60.0	kW	Based on equipment nameplate data (4x units, 15 kW each)
- Commercial Fryers	34.0	kW	Based on equipment nameplate data (2x units, 17 kW each)
- Total Equipment kW	94.0	**kW**	
Kitchen Annual Operating Hours	760	hours	6 hours per day x 5 days per week x 38 weeks per year
Baseline Equipment Efficiency	100%		
Baseline Annual Electric Use	71,440	**kWh**	
Baseline Annual Electric Cost	$ 8,573		
Proposed Equipment Efficiency	100%		
Proposed Fuel Use	2,438	**Therms**	Baseline Electric Use x 3,412 BTU/kWh / 100,000 BTU/Therm
Proposed Fuel Cost	$ 2,745		
Annual Savings	$ 5,828		
Natural Gas Equipment Project Cost	$ 147,816		
Simple Payback	25.4	Years	

*Note to engineer: Link savings back to summary sheet in appropriate column.

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-6: Replace Electric Kitchen Equipment with Natural Gas Equipment - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Electric Equipment Replacement	1	LS	$ -	$ 1,000		$ -	$ 1,246	$ -	$ 1,246	RS Means 2012
(2) Natural Gas-Fired Commercial Fryers	2	EA	$ 12,000	$ 5,000		$ 24,648	$ 12,460	$ -	$ 37,108	Vendor Estimate
(4) Natural Gas-Fired Commercial Warming Ovens	4	EA	$ 12,000	$ 5,000		$ 49,296	$ 24,920	$ -	$ 74,216	Vendor Estimate
Miscellaneous NG Piping	1	LS	$ 2,500	$ 2,500		$ 2,568	$ 3,115	$ -	$ 5,683	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 118,253	Subtotal
$ 29,563	25% Contingency
$ 147,816	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-7: Replace Reach-In Refrigerators and Freezers with Walk-In Unit

Description: This ECM evaluates the electrical energy savings potential assocated with replacing reach-in refrgierators and freezers with one combination refrigerator/freezer walk-in unit. Walk-in refrigeration units can provide the same amount of storage space while consuming less electricity due to the fact that the compressors are larger in size and can be located outside. This ECM assumes that the existing reach-in style units will be removed and *no electrical energy savings will result if both systems are utilized* .

Value	Description	Notes
Existing Refrigeration Systems:		
5	Total Number of Reach-In Refrigerators	
5.8	Amperage of each refrigerator (A)	From Nameplate
120	Voltage of each refrigerator (V)	From Nameplate
2.78	Total kW of Reach-In Refrigerators	Calculated
6	Total Number of Reach-In Freezers	
11	Amperage of each freezer (A)	From Nameplate
120	Voltage of each refrigerator (V)	From Nameplate
6.34	Total kW of Reach-In Freezers	Calculated
Proposed Walk-In Unit:		
7.8	Amperage of Refrigerator Condenser	Provided by Vendor
12.1	Amperage of Freezer Condenser	Provided by Vendor
208	Voltage of Condensers	Provided by Vendor
4.78	Total kW of Condensers	Calculated
6	Amperage of Refrigerator Evaporators (2 at 3A each)	Provided by Vendor
5.4	Amperage of Freezer Evaporators (3 at 1.8A each)	Provided by Vendor
120	Voltage of Evaporators	Provided by Vendor
1.09	Total kW of Evaporators	Calculated
Energy Consumption/Savings:		
6570	Assumed operating hours of refrigeration equipment	75% of 8760
59,918	Existing Annual Electrical Consumption (kWh)	
38,603	Proposed Annual Electrical Consumption (kWh)	
21,316	**Proposed Electrical Energy Savings (kWh)**	

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-7: Replace Reach-In Refrigerators and Freezers with Walk-In Unit - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Combination Walk-In Freezer/Refrigerator	1	LS	$ 38,728	$ 15,000	$ 2,500	$ 39,773	$ 18,690	$ 2,810	$ 61,273	From Vendor
Miscellaneous Electrical	1	LS	$ 2,500	$ 5,000		$ 2,568	$ 6,230	$ -	$ 8,798	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 70,071	Subtotal
$ 17,518	25% Contingency
$ 87,589	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-8: Kitchen Hood Control

Description: This ECM evaluates the thermal and electrical energy savings associated with the implementation of a variable flow controlled exhaust hood (Fan) and make-up air unit. The Hood controller uses infrared heat sensors to detect the level of smoke produced by the cooking operations and automatically adjusts the exhasut fan and make-up air fan to provide the proper amount of air flow needed to remove the particulate from the hood. The system uses a default minimum air flow value to ensure that smoke particulate is removed at all times during cooking operations.

Item	Value	Units	Formula/Comments	
Fuel Cost	$ 1.13	/ Therm		
Electricity Cost	$ 0.12	/kWh		
FORMULA CONSTANTS				
Conversion	0.746	HP/kW		
Constant	24	hrs/day		
Constant	1.08	(btu/hr)/CFM·F		
Conversion	3,412	btu/kWh		
ELECTRIC FAN SAVINGS				
Facility Type	School			
Quantity of Kitchen Hood Fan Motors	4			Q
Kitchen Hood Fan Motor HP	16.0	HP	(2) at 3 HP, (2) at 5 HP	HP
Motor Load Factor	0.90		NJ Protocols	LF
Efficiency of Fan Motor(s)	87.5%			FEFF
Kitchen Hood Fan Run Hours	2,080			RH
Fan Motor Power Reduction (From VFD)	0.584			PR
Fan Electricity Savings	59,645	kWh		
HEATING SAVINGS				
Kitchen is Heated?	Y			
Square Footage of Kitchen	2,500	ft^2	Estimated	SF
Code Required Ventilation Rate	0.70	CFM/ft^2	NJ Protocols	CFM/SF
Ventilation Oversize Factor	1.40		NJ Protocols	OF
Flow Reductuion (from VFD/Control)	0.310			FR
Heating Degree Day	2,783		NJ Protocols Table	HDD
Heating System Efficiency	80%		AFUE (%)	HEFF
Heating Savings	685	MMbtu		
Heating Savings	6,848	Therms		
COOLING SAVINGS				
Kitchen is Cooled?	N			
Cooling Degree Day	-		NJ Protocols Table	CDD
Cooling System Efficiency	-		COP	CEFF
Cooling Savings	-	kWh		
TOTAL SAVINGS				
Electricity Savings	59,645	kWh		
Fuel Savings	6,848	Therms		
Cost Savings	$ 14,869			

Savings calculation formulas are taken from NJ Protocols document for Kitchen Hood

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-8: Kitchen Hood Control - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Me-Link Kitchen Hood Control System	1	ea	$ 15,000	$ 2,000		$ 15,405	$ 2,492	$ -	$ 17,897	Vendor Estimation
5.0 HP VFDs (exhaust fans)	2	ea	$ 1,250	$ 515		$ 2,568	$ 1,283	$ -	$ 3,851	RS Means 2012
5.0 HP Motor	2	ea	$ 570	$ 92		$ 1,171	$ 228	$ -	$ 1,399	RS Means 2012
3.0 HP VFDs (exhaust fans)	2	ea	$ 1,000	$ 515		$ 2,054	$ 1,283	$ -	$ 3,337	RS Means 2012
3.0 HP Motor	2	ea	$ 525	$ 92		$ 1,078	$ 228	$ -	$ 1,306	RS Means 2012
Reprogram DDC system	1	ea	$ 100	$ 1,200		$ 103	$ 1,495	$ -	$ 1,598	RS Means 2012
Electrical - misc.	1	ls	$ 200	$ 500		$ 205	$ 623	$ -	$ 828	RS Means 2012
Remote bulb thermostat	2	ea	$ 500	$ 200		$ 1,027	$ 498	$ -	$ 1,525	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 31,742	Subtotal
$ 7,936	25% Contingency
$ 39,678	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-9: Dishwasher Booster Heater Conversion

Description: This ECM evaluates the energy savings associated with replacing an electrically powered dishwasher booster heater with and equivalently sized natural gas booster heater

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.13	/ Therm	
Electricity Cost	$ 0.09	$/kWh	
Demand Cost	$ 3.38	$/kW	
FORMULA CONSTANTS			
CF	0.3		Coincidence Factor (NJ Protocols)
EFLH	1,000		Equivalent Full Load Hours (NJ Protocols)
PROPOSED EQUIPMENT			
Input Rating	100,000	btu/hr	
Efficiency	80%		
Fuel Usage	1,000	Therms	
SAVINGS			
Electricity Savings	23,447	kWh	
Demand Savings	7	kW	
Fuel Cost Savings	$ 1,008		

Savings calculation formulas are taken from NJ Protocols document for Booster Heater

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-9: Dishwasher Booster Heater Conversion - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Natural Gas Fired Booster Heater	1	EA	$ 5,000	$ 2,500		$ 5,135	$ 3,115	$ -	$ 8,250	RS Means 2012
Venting, Piping, Ect.	1	LS	$ 1,000	$ 500		$ 1,027	$ 623	$ -	$ 1,650	RS Means 2012
Piping	1	LS	$ 1,000	$ 1,000		$ 1,027	$ 1,246	$ -	$ 2,273	RS Means 2012
Electric	1	LS		$ 1,000		$ -	$ 1,246	$ -	$ 1,246	RS Means 2012

$ 13,419	Subtotal
$ 3,355	25% Contingency
$ 16,800	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-10: Install Vending Machine Controls

Description : Vending machines generally operate 24/7 regardless of the actual usage. This measure proposes installing vending machine controls to reduce the total run time of these units. Cold beverage machines will cycle on for 15 minutes every two hours in order to keep beverages at a desired temperature. The result is a reduction in total electrical energy usage.

Unit Cost: $0.120 $/kWh blended

Energy Savings Calculations:

	Existing	
Cold Beverage Vending Machine Electric usage	7,008	kWh[1,4,7]
Snack Vending Machine Electric usage	3,504	kWh[2,5,7]
Frozen Food Vending Machine Electric Usage	6,570	kWh[3,6,7]
Total Vending Machine Electric Usage	17,082	kWh
	Proposed	
Cold Beverage Vending Machine Electric usage	1,181	kWh[8]
Snack Vending Machine Electric usage	675	kWh
Frozen Vending Machine Electric Usage	1,266	kWh
Total Vending Machine Electric Usage	3,122	kWh
Vending Machine Controls Usage Savings	**13,960**	**kWh**
Total cost savings	**$ 1,675**	
Estimated Total Project Cost	**$ 1,401**	[9]
Simple Payback	**1**	**years**

Assumptions

1	2	Number of cold beverage vending machines
2	2	Number of snack vending machines
3	1	Number of dual snack/beverage vending machines
4	400	Average wattage, typical of cold beverage machines based on prior project experience
5	200	Average wattage, typical of snack machines based on prior project experience
6	750	Average wattage, typical of frozen food machines based on prior project experience
7	8760	Hours per year vending machine plugged in
8	3375	Building Occupied Hours
9	0.50	Vending Machine Traffic Factor (0.75 for High Traffic, 0.5 for Medium, 0.25 for low)

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-10: Install Vending Machine Controls - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Vending Miser	5	EA	$ 200	$ 15	$ -	$ 1,027	$ 93	$ -	$ 1,120	Vendor Estimation
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,120	Subtotal
$ 280	25% Contingency
$ 1,401	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-11: Computer Network Controller Savings Calculations

Notes:

1. This ECM calculates the saving associated with the installation of a centralized computer management software installed on the client server that will cause the computers to hibernate and sleep during times of low or no usage.
2. Energy savings per computer are based on manuafactures historical information from previous installations
3. There are approximately 5 computers used in this building

Background Data **Average Consumption and Savings Figures**	**kWh**
Average Total Consumption per PC per Year	500-700
Average Energy and Cost Waste per PC per Year	350-450
Average savings per PC	70
Average savings per IMac	50

Number of PCs	185
Number of IMac's	0
Return on Investment Analysis	
	kWh
Annual Energy Savings	12,950
Total network controller software package cost	$1,776

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-11: Computer Network Controller Savings Calculations - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Computer Network Controller Software	1	LS	$ 625	$ 625	$ -	$ 642	$ 779	$ -	$ 1,421	Vendor Estimation
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,421	Subtotal
$ 355	25% Contingency
$ 1,776	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-12: Replace urinals and flush valves with low flow

Description: This ECM evaluates the water savings associated with replacing/ upgrading urinals with 0.125 GPF urinals and or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Urinals in Building to be replaced	4	
Average Flushes / Urinal (per Day)	10	Based on # of occupants
Average Gallons / Flush	1.5	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	4	
Proposed Gallons / Flush	0.125	Gal
Proposed Material Cost of new urinal & valve	$1,200	RS Means 2012
Proposed Installation Cost of new urinal & valve	$1,000	RS Means 2012
Total cost of new urinals & valves		

SAVINGS		
Current Urinal Water Use	21.90	kGal / year
Proposed Urinal Water Use	1.83	kGal / year
Water Savings	20.08	kGal / year
Cost Savings	$181	/ year

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-12: Replace toilets and flush valves with low flow

Description: This ECM evaluates the water savings associated with repalcing/ upgrading toilets to 1.28 GPF fixtures and/or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Toilets in Building	14	
Average Flushes / Toilet (per Day)	10	Based on # of occupants
Average Gallons / Flush	2.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	14	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	127.75	kGal / year
Proposed Toilet Water Use	65.41	kGal / year
Water Savings	62.34	kGal / year
Cost Savings	$561	/ year

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

ECM-12: Replace faucets with low flow

Description; This ECM evaluates the water savings resulting from replacing/ upgrading faucets to 0.5 gallon per minute flow

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Faucets in Building	20	
Average Uses / Faucet (per day)	10	Based on # of occupants
Average Time of Use	10.0	seconds
Average Flowrate	2.0	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	20	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	$ 1.13	/Therm
Number of Faucets	20	
Hours per Day of Usage	0.5	hrs
Days per Year of Facility Usage	182	days
Average Flowrate	2.0	gpm
Proposed Flowrate	0.5	gpm
Heat Content of Water	8.33	Btu/gal/F
Temperature Difference (Intake and Output)	50	F
Water Heating Equipment Efficiency	80%	
Conversion Factor	100,000	Btu/Therm
SAVINGS		
Current Faucet Water Use	12.13	kGal / year
Proposed Faucet Water Use	3.03	kGal / year
Water Savings	9.10	kGal / year
Heating Savings	375	Therms
Cost Savings	$504	/ year

Savings calculation formulas are taken from NJ Protocols document for Faucet

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Replace Plumbing Fixtures with Low-Flow Equivalents - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Low-Flow Urinal	4	EA	$ 1,200	$ 1,000	$ -	$ 4,930	$ 4,984	$ -	$ 9,914	Vendor Estimate
Low-Flow Toilet	14	EA	$ 1,400	$ 1,000	$ -	$ 20,129	$ 17,444	$ -	$ 37,573	Vendor Estimate
Low-Flow Faucet	20	EA	$ 20	$ 20	$ -	$ 411	$ 498	$ -	$ 909	Vendor Estimate
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 48,396	Subtotal
$ 12,099	25% Contingency
$ 60,495	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 1

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	45,945
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$67,089	$32,117
Existing Usage (from utility)	566,039	28,516
Proposed Savings	412,470	7,122
Existing Total MMBtus	4,783	
Proposed Savings MMBtus	2,120	
% Energy Reduction	**44.3%**	
Proposed Annual Savings	$55,029	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$45,372	$8,902	$54,274
Incentive #3	$45,372	$8,902	$54,274
Total All Incentives	**$90,743**	**$17,805**	**$113,548**

Total Project Cost	$1,209,331

		Allowable Incentive
% Incentives #1 of Utility Cost*	5.0%	$5,000
% Incentives #2 of Project Cost**	4.5%	$54,274
% Incentives #3 of Project Cost**	4.5%	$54,274
Total Eligible Incentives***	**$113,548**	
Project Cost w/ Incentives	$1,095,783	

Project Payback (years)	
w/o Incentives	w/ Incentives
22.0	19.9

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
ECM-L1 Lighting Replacements

		EXISTING CONDITIONS							RETROFIT CONDITIONS							COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	Breaker	2280	105	2	CF 23	CFS23/1	23	0.0	Breaker	2,280	105	-	0.0	$ -	$ -	$0		#DIV/0!
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	SW	2280	105	2	CF 23	CFS23/1	23	0.0	SW	2,280	105	-	0.0	$ -	$ -	$0		#DIV/0!
117	Front Lobby	2	CF 23	CFS23/1	23	0.0	SW	2280	105	2	CF 23	CFS23/1	23	0.0	SW	2,280	105	-	0.0	$ -	$ -	$0		#DIV/0!
54LED	Front Lobby	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	2280	1,970	12	STLED4	STLED4	40	0.5	SW	2,280	1,094	876	0.4	$ 95.16	$ 3,380.40	$600	35.5	29.2
54LED	Front Main Hallway	18	B 34 C F 2 (MAG)	F42EE	72	1.3	SW	2280	2,955	18	STLED4	STLED4	40	0.7	SW	2,280	1,642	1,313	0.6	$ 142.73	$ 5,070.60	$900	35.5	29.2
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880	10	STLED4	STLED4	40	0.4	SW	3,200	1,280	1,600	0.5	$ 165.30	$ 2,817.00	$500	17.0	14.0
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880	10	STLED4	STLED4	40	0.4	SW	3,200	1,280	1,600	0.5	$ 165.30	$ 2,817.00	$500	17.0	14.0
6LED	101 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	SW	3,200	320	416	0.1	$ 42.98	$ 607.50	$100	14.1	11.8
6LED	Attendance/Receptionist	4	T 34 R F 3 (MAG)	F43EE	115	0.5	SW	3120	1,435	4	T 74 R LED	RTLED50	50	0.2	SW	3,120	624	811	0.3	$ 84.08	$ 1,215.00	$200	14.4	12.1
54LED	Superintendant's Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3120	449	2	STLED4	STLED4	40	0.1	SW	3,120	250	200	0.1	$ 20.70	$ 563.40	$100	27.2	22.4
35LED	Superintendant's Secretary	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,404	5	T 59 R LED	RTLED38	38	0.2	SW	3,120	593	811	0.3	$ 84.08	$ 1,518.75	$250	18.1	15.1
35LED	Superintendant's Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	T 59 R LED	RTLED38	38	0.2	SW	3,120	474	649	0.2	$ 67.27	$ 1,215.00	$200	18.1	15.1
55LED	Superintendant's Office	2	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	3120	293	2	2T 25 R LED	2RTLED	25	0.1	SW	3,120	156	137	0.0	$ 14.23	$ 405.00	$100	28.5	21.4
6LED	Superintendant's Office Confidential Closet	1	T 34 R F 3 (MAG)	F43EE	115	0.1	SW	3120	359	1	T 74 R LED	RTLED50	50	0.1	SW	3,120	156	203	0.1	$ 21.02	$ 303.75	$50	14.4	12.1
55LED	Board Conference Room	8	2T 17 R F 3 (ELE)	F23ILL	47	0.4	SW	3120	1,173	8	2T 25 R LED	2RTLED	25	0.2	SW	3,120	624	549	0.2	$ 56.92	$ 1,620.00	$400	28.5	21.4
35LED	103 Board Office	10	T 32 R F 3 (ELE)	F43ILL/2	90	0.9	SW	3120	2,808	10	T 59 R LED	RTLED38	38	0.4	SW	3,120	1,186	1,622	0.5	$ 168.17	$ 3,037.50	$500	18.1	15.1
35LED	103 Board Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,685	6	T 59 R LED	RTLED38	38	0.2	SW	3,120	711	973	0.3	$ 100.90	$ 1,822.50	$300	18.1	15.1
55LED	103 Board Office	1	2T 17 R F 3 (ELE)	F23ILL	47	0.0	SW	3120	147	1	2T 25 R LED	2RTLED	25	0.0	SW	3,120	78	69	0.0	$ 7.11	$ 202.50	$50	28.5	21.4
6LED	103 Board Office	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3120	718	2	T 74 R LED	RTLED50	50	0.1	SW	3,120	312	406	0.1	$ 42.04	$ 607.50	$100	14.4	12.1
35LED	Payroll Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	T 59 R LED	RTLED38	38	0.2	SW	3,120	474	649	0.2	$ 67.27	$ 1,215.00	$200	18.1	15.1
218LED	102 Cosmetology	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	SW	3200	3,456	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,920	0.6	$ 198.36	$ 3,380.40	$600	17.0	14.0
218LED	102 Cosmetology	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	1,280	0.4	$ 132.24	$ 2,253.60	$400	17.0	14.0
6LED	102 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	SW	3,200	320	416	0.1	$ 42.98	$ 607.50	$100	14.1	11.8
28	Mens Restroom	5	CR 32 C F 1	FC12/1	31	0.2	SW	1000	155	5	CR 32 C F 1	FC12/1	31	0.2	SW	1,000	155	-	0.0	$ -	$ -	$0		#DIV/0!
54LED	Mens Restroom	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	SW	1,000	160	128	0.1	$ 16.97	$ 1,126.80	$200	66.4	54.6
117	Janitor's Closet	1	CF 23	CFS23/1	23	0.0	SW	1000	23	1	CF 23	CFS23/1	23	0.0	SW	1,000	23	-	0.0	$ -	$ -	$0		#DIV/0!
218LED	Admission Curriculum & Programs Office	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	STLED4	STLED4	40	0.2	SW	3,120	499	624	0.2	$ 64.68	$ 1,126.80	$200	17.4	14.3
218LED	DISS Office	2	W 32 P F 3 (ELE)	F43ILL/2	90	0.2	SW	3120	562	2	STLED4	STLED4	40	0.1	SW	3,120	250	312	0.1	$ 32.34	$ 563.40	$100	17.4	14.3
218LED	DISS Office	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	3120	281	1	STLED4	STLED4	40	0.0	SW	3,120	125	156	0.1	$ 16.17	$ 281.70	$50	17.4	14.3
6LED	Grants Office	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3120	1,076	3	T 74 R LED	RTLED50	50	0.2	SW	3,120	468	608	0.2	$ 63.06	$ 911.25	$150	14.4	12.1
35LED	104A Computer Lab	9	T 32 R F 3 (ELE)	F43ILL/2	90	0.8	SW	3200	2,592	9	T 59 R LED	RTLED38	38	0.3	SW	3,200	1,094	1,498	0.5	$ 154.72	$ 2,733.75	$450	17.7	14.8
35LED	108 Finance & Business Academy	16	T 32 R F 3 (ELE)	F43ILL/2	90	1.4	SW	3200	4,608	16	T 59 R LED	RTLED38	38	0.6	SW	3,200	1,946	2,662	0.8	$ 275.06	$ 4,860.00	$800	17.7	14.8
6LED	108 Data Room 1	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	SW	3,200	320	416	0.1	$ 42.98	$ 607.50	$100	14.1	11.8
6LED	108 Data Room 2	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3200	1,104	3	T 74 R LED	RTLED50	50	0.2	SW	3,200	480	624	0.2	$ 64.47	$ 911.25	$150	14.1	11.8
35LED	105 Multimedia	18	T 32 R F 3 (ELE)	F43ILL/2	90	1.6	SW	3200	5,184	18	T 59 R LED	RTLED38	38	0.7	SW	3,200	2,189	2,995	0.9	$ 309.44	$ 5,467.50	$900	17.7	14.8
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	SW	3,200	960	1,248	0.4	$ 128.93	$ 1,822.50	$300	14.1	11.8
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	SW	3,200	960	1,248	0.4	$ 128.93	$ 1,822.50	$300	14.1	11.8
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	SW	3,200	960	1,248	0.4	$ 128.93	$ 1,822.50	$300	14.1	11.8
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	SW	3,200	960	1,248	0.4	$ 128.93	$ 1,822.50	$300	14.1	11.8
6LED	104 Classroom	7	T 34 R F 3 (MAG)	F43EE	115	0.8	SW	3200	2,576	7	T 74 R LED	RTLED50	50	0.4	SW	3,200	1,120	1,456	0.5	$ 150.42	$ 2,126.25	$350

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
ECM-L1 Lighting Replacements

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
	Total	706				71.7			214,036	706			5,272	31.0				89,873	124,163	40.7	$12,910	$224,832	$38,035		
																		Demand Savings			40.7	$1,735			
																		kWh Savings			124,163	$11,175			
																		Total savings				$12,910		17.4	14.5

Morris County Vocational Technical School LGEA - Building 1

CHA Project No. 28950

ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	Breaker	2280	104.9	2	CF 23	CFS23/1	23	0.0	NONE	2280	104.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	SW	2280	104.9	2	CF 23	CFS23/1	23	0.0	NONE	2280	104.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
117	Front Lobby	2	CF 23	CFS23/1	23	0.0	SW	2280	104.9	2	CF 23	CFS23/1	23	0.0	NONE	2280	104.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Front Lobby	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	2280	1,969.9	12	B 34 C F 2 (MAG)	F42EE	72	0.9	NONE	2280	1,969.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Front Main Hallway	18	B 34 C F 2 (MAG)	F42EE	72	1.3	SW	2280	2,954.9	18	B 34 C F 2 (MAG)	F42EE	72	1.3	NONE	2280	2,954.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880.0	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	C-OCC	2240	2,016.0	864.0	0.0	$77.76	$270.00	$35.00	3.5	3.0
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880.0	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	C-OCC	2240	2,016.0	864.0	0.0	$77.76	$270.00	$35.00	3.5	3.0
6LED	101 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736.0	2	T 34 R F 3 (MAG)	F43EE	115	0.2	C-OCC	2240	515.2	220.8	0.0	$19.87	$270.00	$35.00	13.6	11.8
6LED	Attendance/Receptionist	4	T 34 R F 3 (MAG)	F43EE	115	0.5	SW	3120	1,435.2	4	T 34 R F 3 (MAG)	F43EE	115	0.5	NONE	3120	1,435.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Superintendant's Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3120	449.3	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3120	449.3	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
35LED	Superintendant's Secretary	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,404.0	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	2184	982.8	421.2	0.0	$37.91	$270.00	$35.00	7.1	6.2
35LED	Superintendant's Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123.2	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	C-OCC	2184	786.2	337.0	0.0	$30.33	$270.00	$35.00	8.9	7.7
55LED	Superintendant's Office	2	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	3120	293.3	2	2T 17 R F 3 (ELE)	F23ILL	47	0.1	C-OCC	2184	205.3	88.0	0.0	$7.92	$270.00	$35.00	34.1	29.7
6LED	Superintendant's Office Confidential Closet	1	T 34 R F 3 (MAG)	F43EE	115	0.1	SW	3120	358.8	1	T 34 R F 3 (MAG)	F43EE	115	0.1	NONE	3120	358.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
55LED	Board Conference Room	8	2T 17 R F 3 (ELE)	F23ILL	47	0.4	SW	3120	1,173.1	8	2T 17 R F 3 (ELE)	F23ILL	47	0.4	C-OCC	2184	821.2	351.9	0.0	$31.67	$270.00	$35.00	8.5	7.4
35LED	103 Board Office	10	T 32 R F 3 (ELE)	F43ILL/2	90	0.9	SW	3120	2,808.0	10	T 32 R F 3 (ELE)	F43ILL/2	90	0.9	NONE	3120	2,808.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
35LED	103 Board Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,684.8	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	2184	1,179.4	505.4	0.0	$45.49	$270.00	$35.00	5.9	5.2
55LED	103 Board Office	1	2T 17 R F 3 (ELE)	F23ILL	47	0.0	SW	3120	146.6	1	2T 17 R F 3 (ELE)	F23ILL	47	0.0	NONE	3120	146.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
6LED	103 Board Office	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3120	717.6	2	T 34 R F 3 (MAG)	F43EE	115	0.2	NONE	3120	717.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
35LED	Payroll Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123.2	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	NONE	3120	1,123.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	102 Cosmetology	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	SW	3200	3,456.0	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	C-OCC	2240	2,419.2	1,036.8	0.0	$93.31	$270.00	$35.00	2.9	2.5
218LED	102 Cosmetology	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304.0	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.7	C-OCC	2240	1,612.8	691.2	0.0	$62.21	$270.00	$35.00	4.3	3.8
6LED	102 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736.0	2	T 34 R F 3 (MAG)	F43EE	115	0.2	C-OCC	2240	515.2	220.8	0.0	$19.87	$270.00	$35.00	13.6	11.8
28	Mens Restroom	5	CR 32 C F 1	FC12/1	31	0.2	SW	1000	155.0	5	CR 32 C F 1	FC12/1	31	0.2	NONE	1000	155.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Mens Restroom	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288.0	4	B 34 C F 2 (MAG)	F42EE	72	0.3	NONE	1000	288.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
117	Janitor's Closet	1	CF 23	CFS23/1	23	0.0	SW	1000	23.0	1	CF 23	CFS23/1	23	0.0	NONE	1000	23.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	Admission Curriculum & Programs Office	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123.2	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.4	C-OCC	2184	786.2	337.0	0.0	$30.33	$270.00	$35.00	8.9	7.7
218LED	DISS Office	2	W 32 P F 3 (ELE)	F43ILL/2	90	0.2	SW	3120	561.6	2	W 32 P F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2184	393.1	168.5	0.0	$15.16	$270.00	$35.00	17.8	15.5
218LED	DISS Office	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	3120	280.8	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	C-OCC	2184	196.6	84.2	0.0	$7.58	$270.00	$35.00	35.6	31.0
6LED	Grants Office	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3120	1,076.4	3	T 34 R F 3 (MAG)	F43EE	115	0.3	C-OCC	2184	753.5	322.9	0.0	$29.06	$270.00	$35.00	9.3	8.1
35LED	104A Computer Lab	9	T 32 R F 3 (ELE)	F43ILL/2	90	0.8	SW	3200	2,592.0	9	T 32 R F 3 (ELE)	F43ILL/2	90	0.8	C-OCC	2240	1,814.4	777.6	0.0	$69.98	$270.00	$35.00	3.9	3.4
35LED	108 Finance & Business Academy	16	T 32 R F 3 (ELE)	F43ILL/2	90	1.4	SW	3200	4,608.0	16	T 32 R F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	2240	3,225.6	1,382.4	0.0	$124.42	$270.00	$35.00	2.2	1.9
6LED	108 Data Room 1	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736.0	2	T 34 R F 3 (MAG)	F43EE	115	0.2	C-OCC	2240	515.2	220.8	0.0	$19.87	$270.00	$35.00	13.6	11.8
6LED	108 Data Room 2	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3200	1,104.0	3	T 34 R F 3 (MAG)	F43EE	115	0.3	C-OCC	2240	772.8	331.2	0.0	$29.81	$270.00	$35.00	9.1	7.9
35LED	105 Multimedia	18	T 32 R F 3 (ELE)	F43ILL/2	90	1.6	SW	3200	5,184.0	18	T 32 R F 3 (ELE)	F43ILL/2	90	1.6	C-OCC	2240	3,628.8	1,555.2	0.0	$139.97	$270.00	$35.00	1.9	1.7
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208.0	6	T 34 R F 3 (MAG)	F43EE	115	0.7	C-OCC	2240	1,545.6	662.4	0.0	$59.62	$270.00	$35.00	4.5	3.9
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208.0	6	T 34 R F 3 (MAG)	F43EE	115	0.7	C-OCC	2240	1,545.6	662.4	0.0	$59.62	$270.00	$35.00	4.5	3.9
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208.0	6	T 34 R F 3 (MAG)	F43EE	115	0.7	C-OCC	2240	1,545.6	662.4	0.0	$59.62	$270.00	$35.00	4.5	3.9
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208.0	6	T 34 R F 3 (MAG)	F43EE	115	0.7	C-OCC	2240	1,545.6	662.4	0.0	$59.62	$270.00	$35.00	4.5	3.9
6LED	104 Classroom	7	T 34 R F 3 (MAG)	F43EE	115	0.8	SW	3200	2,576.0	7	T 34 R F 3 (MAG)	F43EE	115	0.8	C-OCC	2240	1,803.2	772.8	0.0	$69.55	$270.00	$35.00	3.9	3.4

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	Breaker	2280	105	2	CF 23	CFS23/1	23	0.0	NONE	2,280	105	-	0.0	$ -	$ -	$ -		
117	Front Entrance	2	CF 23	CFS23/1	23	0.0	SW	2280	105	2	CF 23	CFS23/1	23	0.0	NONE	2,280	105	-	0.0	$ -	$ -	$ -		
117	Front Lobby	2	CF 23	CFS23/1	23	0.0	SW	2280	105	2	CF 23	CFS23/1	23	0.0	NONE	2,280	105	-	0.0	$ -	$ -	$ -		
54LED	Front Lobby	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	2280	1,970	12	STLED4	STLED4	40	0.5	NONE	2,280	1,094	876	0.4	$ 95.16	$ 3,380.40	$ 600	35.5	29.2
54LED	Front Main Hallway	18	B 34 C F 2 (MAG)	F42EE	72	1.3	SW	2280	2,955	18	STLED4	STLED4	40	0.7	NONE	2,280	1,642	1,313	0.6	$ 142.73	$ 5,070.60	$ 900	35.5	29.2
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880	10	STLED4	STLED4	40	0.4	C-OCC	2,240	896	1,984	0.5	$ 199.86	$ 3,087.00	$ 535	15.4	12.8
218LED	101 Cosmetology	10	W 32 P F 3 (ELE)	F43ILL/2	90	0.9	SW	3200	2,880	10	STLED4	STLED4	40	0.4	C-OCC	2,240	896	1,984	0.5	$ 199.86	$ 3,087.00	$ 535	15.4	12.8
6LED	101 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	C-OCC	2,240	224	512	0.1	$ 51.62	$ 877.50	$ 135	17.0	14.4
6LED	Attendance/Receptionist	4	T 34 R F 3 (MAG)	F43EE	115	0.5	SW	3120	1,435	4	T 74 R LED	RTLED50	50	0.2	NONE	3,120	624	811	0.3	$ 84.08	$ 1,215.00	$ 200	14.4	12.1
54LED	Superintendant's Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3120	449	2	STLED4	STLED4	40	0.1	NONE	3,120	250	200	0.1	$ 20.70	$ 563.40	$ 100	27.2	22.4
35LED	Superintendant's Secretary	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,404	5	T 59 R LED	RTLED38	38	0.2	C-OCC	2,184	415	989	0.3	$ 100.09	$ 1,788.75	$ 285	17.9	15.0
35LED	Superintendant's Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	T 59 R LED	RTLED38	38	0.2	C-OCC	2,184	332	791	0.2	$ 80.07	$ 1,485.00	$ 235	18.5	15.6
55LED	Superintendant's Office	2	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	3120	293	2	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,184	109	184	0.0	$ 18.44	$ 675.00	$ 135	36.6	29.3
6LED	Superintendant's Office Confidential Closet	1	T 34 R F 3 (MAG)	F43EE	115	0.1	SW	3120	359	1	T 74 R LED	RTLED50	50	0.1	NONE	3,120	156	203	0.1	$ 21.02	$ 303.75	$ 50	14.4	12.1
55LED	Board Conference Room	8	2T 17 R F 3 (ELE)	F23ILL	47	0.4	SW	3120	1,173	8	2T 25 R LED	2RTLED	25	0.2	C-OCC	2,184	437	736	0.2	$ 73.77	$ 1,890.00	$ 435	25.6	19.7
35LED	103 Board Office	10	T 32 R F 3 (ELE)	F43ILL/2	90	0.9	SW	3120	2,808	10	T 59 R LED	RTLED38	38	0.4	NONE	3,120	1,186	1,622	0.5	$ 168.17	$ 3,037.50	$ 500	18.1	15.1
35LED	103 Board Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3120	1,685	6	T 59 R LED	RTLED38	38	0.2	C-OCC	2,184	498	1,187	0.3	$ 120.11	$ 2,092.50	$ 335	17.4	14.6
55LED	103 Board Office	1	2T 17 R F 3 (ELE)	F23ILL	47	0.0	SW	3120	147	1	2T 25 R LED	2RTLED	25	0.0	NONE	3,120	78	69	0.0	$ 7.11	$ 202.50	$ 50	28.5	21.4
6LED	103 Board Office	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3120	718	2	T 74 R LED	RTLED50	50	0.1	NONE	3,120	312	406	0.1	$ 42.04	$ 607.50	$ 100	14.4	12.1
35LED	Payroll Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	T 59 R LED	RTLED38	38	0.2	NONE	3,120	474	649	0.2	$ 67.27	$ 1,215.00	$ 200	18.1	15.1
218LED	102 Cosmetology	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	SW	3200	3,456	12	STLED4	STLED4	40	0.5	C-OCC	2,240	1,075	2,381	0.6	$ 239.83	$ 3,650.40	$ 635	15.2	12.6
218LED	102 Cosmetology	8	W 32 P F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,587	0.4	$ 159.89	$ 2,523.60	$ 435	15.8	13.1
6LED	102 Cosmetology Locker Room	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	C-OCC	2,240	224	512	0.1	$ 51.62	$ 877.50	$ 135	17.0	14.4
28	Mens Restroom	5	CR 32 C F 1	FC12/1	31	0.2	SW	1000	155	5	CR 32 C F 1	FC12/1	31	0.2	NONE	1,000	155	-	0.0	$ -	$ -	$ -		
54LED	Mens Restroom	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	NONE	1,000	160	128	0.1	$ 16.97	$ 1,126.80	$ 200	66.4	54.6
117	Janitor's Closet	1	CF 23	CFS23/1	23	0.0	SW	1000	23	1	CF 23	CFS23/1	23	0.0	NONE	1,000	23	-	0.0	$ -	$ -	$ -		
218LED	Admission Curriculum & Programs Office	4	W 32 P F 3 (ELE)	F43ILL/2	90	0.4	SW	3120	1,123	4	STLED4	STLED4	40	0.2	C-OCC	2,184	349	774	0.2	$ 78.16	$ 1,396.80	$ 235	17.9	14.9
218LED	DISS Office	2	W 32 P F 3 (ELE)	F43ILL/2	90	0.2	SW	3120	562	2	STLED4	STLED4	40	0.1	C-OCC	2,184	175	387	0.1	$ 39.08	$ 833.40	$ 135	21.3	17.9
218LED	DISS Office	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	3120	281	1	STLED4	STLED4	40	0.0	C-OCC	2,184	87	193	0.1	$ 19.54	$ 551.70	$ 85	28.2	23.9
6LED	Grants Office	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3120	1,076	3	T 74 R LED	RTLED50	50	0.2	C-OCC	2,184	328	749	0.2	$ 75.70	$ 1,181.25	$ 185	15.6	13.2
35LED	104A Computer Lab	9	T 32 R F 3 (ELE)	F43ILL/2	90	0.8	SW	3200	2,592	9	T 59 R LED	RTLED38	38	0.3	C-OCC	2,240	766	1,826	0.5	$ 184.27	$ 3,003.75	$ 485	16.3	13.7
35LED	108 Finance & Business Academy	16	T 32 R F 3 (ELE)	F43ILL/2	90	1.4	SW	3200	4,608	16	T 59 R LED	RTLED38	38	0.6	C-OCC	2,240	1,362	3,246	0.8	$ 327.59	$ 5,130.00	$ 835	15.7	13.1
6LED	108 Data Room 1	2	T 34 R F 3 (MAG)	F43EE	115	0.2	SW	3200	736	2	T 74 R LED	RTLED50	50	0.1	C-OCC	2,240	224	512	0.1	$ 51.62	$ 877.50	$ 135	17.0	14.4
6LED	108 Data Room 2	3	T 34 R F 3 (MAG)	F43EE	115	0.3	SW	3200	1,104	3	T 74 R LED	RTLED50	50	0.2	C-OCC	2,240	336	768	0.2	$ 77.43	$ 1,181.25	$ 185	15.3	12.9
35LED	105 Multimedia	18	T 32 R F 3 (ELE)	F43ILL/2	90	1.6	SW	3200	5,184	18	T 59 R LED	RTLED38	38	0.7	C-OCC	2,240	1,532	3,652	0.9	$ 368.54	$ 5,737.50	$ 935	15.6	13.0
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	C-OCC	2,240	672	1,536	0.4	$ 154.85	$ 2,092.50	$ 335	13.5	11.3
6LED	107 Digital Design	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	C-OCC	2,240	672	1,536	0.4	$ 154.85	$ 2,092.50	$ 335	13.5	11.3
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	C-OCC	2,240	672	1,536	0.4	$ 154.85	$ 2,092.50	$ 335	13.5	11.3
6LED	106 Network & Info Tech	6	T 34 R F 3 (MAG)	F43EE	115	0.7	SW	3200	2,208	6	T 74 R LED	RTLED50	50	0.3	C-OCC	2,240	672	1,536	0.4	$ 154.85	$ 2,092.50	$ 335	13.5	11.3
6LED	104 Classroom	7	T 34 R F 3 (MAG)	F43EE	115	0.8	SW	3200	2,576	7	T 74 R LED	RTLED50	50	0.4	C-OCC	2,240	784	1,792	0.5	$ 180.66	$ 2,396.25	$ 385	13.3	11.1

Morris County Vocational Technical School LGEA - Building 1
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
															0	#N/A								#VALUE!

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

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COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

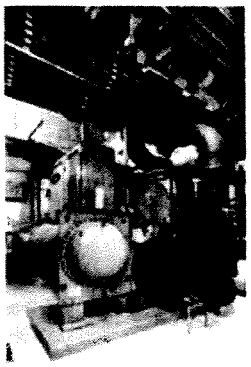
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

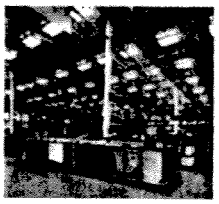
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

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New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX E

Photovoltaic Analysis

APPENDIX F

Photos



1: Building 1 from Main Street



2: Old RTUs



3: Main Hallway & Old Lighting



4: Fitness Center Lighting next to Skylight



5: Computer Room



6: Electric Kitchen Equipment

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

38

ENERGY STAR® Score[1]

Building 1

Primary Property Function: K-12 School
Gross Floor Area (ft²): 45,945
Built: 1956

For Year Ending: May 31, 2014
Date Generated: October 27, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Building 1 400 East Main Street Denville, New Jersey 07834	Morris County Vocational School District 400 E Main Street Denville, NJ 07834 (____)____-_____	Mike Orlovsky 400 E Main Street Denville, NJ 07834 (518)453-3980 mdewein@chacompanies.com

Property ID: 4195749

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
101.1 kBtu/ft²

Source EUI
187.7 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	2,851,590 (61%)
Electric - Grid (kBtu)	1,792,859 (39%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	91
National Median Source EUI (kBtu/ft²)	169
% Diff from National Median Source EUI	11%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	392

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 2

400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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F Photos
G EPA Benchmarking Report

REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 2 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 2	400 E Main St, Denville, NJ 07834	9,225	1956

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
40,566	2,823	9,255	48.2

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

Summary of Energy Conservation Measures

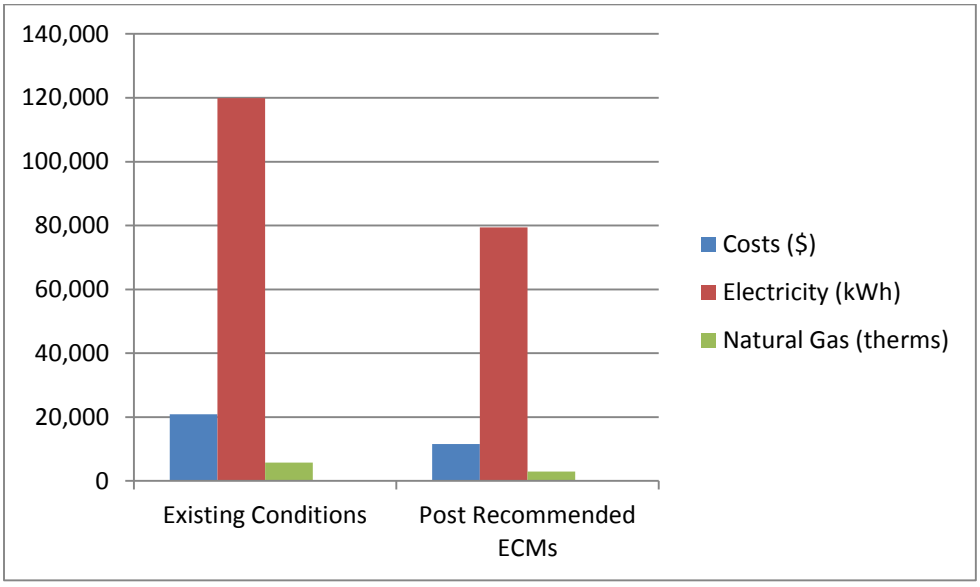
ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Replace Door Seals	922	166	5.6	0	5.6	Y
2	Roof Replacement/Insulation Improvement	320,563	2,001	160.2	0	160.2	Y
3	Replace Boiler with Condensing Boiler	51,554	1,406	36.7	1,750	35.4	Y
4	Install HHW Pump VFDs & Premium Efficiency Motors	3,888	1,129	3.4	460	3.0	Y
5	Condensing Domestic Hot Water Heater	9,127	1,474	6.2	50	6.2	Y
6	Computer Network Controller	1,776	151	11.7	0	11.7	Y
7	Install Low Flow Plumbing Fixtures	23,368	849	27.5	0	27.5	Y
L1	Lighting Replacements / Upgrades	38,819	1,816	21.4	7,050	17.5	N
L2	Install Lighting Controls (Add Occupancy Sensors)	6,210	857	7.2	805	6.3	N
L3	Lighting Replacements with Controls (Occupancy Sensors)	45,029	2,080	21.7	7,855	17.9	Y
	Total**	456,226	9,255	49	10,115	48	
	Total (Recommended)	456,226	9,255	49	10,115	48	

* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

No alternative energy measures are recommended.

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	19,919	10,664	46%
Electricity (kWh)	119,944	79,378	34%
Natural Gas (therms)	5,726	2,903	49%
Site EUI (kbtu/SF/Yr)	106.4	60.8	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 2
Gross Floor Area: 9,225
Number of Floors: 1
Year Built: 1956
Additions: None



Description of Spaces: Classrooms, offices, storage rooms, toilet rooms and a mechanical room.
Description of Occupancy: This building houses classroom spaces for secondary or high school level and post-secondary/adult vocational and technical education.
Number of Computers: The school has approximately 18 desktop computers.
Building Usage: The secondary school hours of operation are 8:15 AM – 3:00 PM Monday through Friday, with various post-secondary activities until 6:00 PM. Custodians are in the building until 11:00 each night. In general the occupied hours are considered 80 hours per week, 10 months per year

Building Envelope

Construction Materials: Steel framed concrete masonry unit (CMU) exterior walls
Façade: Brick exterior fascia
Roof: Concrete and metal roof decking with minimal insulation, rolled asphalt exterior finish. An ECM for adding additional roof insulation is included.
Windows: Double pane glazing with aluminum frames. These windows were in fair condition and no ECMs are included.
Exterior Doors: Double pane full window doors with aluminum frames. The door sweeps and seals are in poor condition and a ECM is included to assess energy savings associated with their replacement.

Heating Ventilation & Air Conditioning (HVAC) Systems

HVAC Equipment: Heating, ventilation and cooling is provided by six (6) Trane packaged direct expansion (DX) RTUs having hot water heating coils supplied by a boiler. These units are brand new and were still being installed during the building walkthrough. These RTUs serve constant volume ducted distribution systems.

In addition to the conditioned air provided by the RTUs, there is perimeter fin tube radiation installed around the building for supplemental heating. Heating hot water for this perimeter fin tube as well as the heating coils in the RTUs is provided by one HB Smith cast iron sectional hot water boiler. This boiler maintains 180°F heating hot water supply temperature during heating season at an approximate 80% system efficiency. The heating hot water is distributed to the terminal devices described above by one 5 HP supply pump.

The HVAC systems are generally in good condition; however, the boiler and heating hot water pump have reached the end of their useful life. An ECM has been included to replace this boiler and pump with a high efficiency condensing boiler and upgrade the pump with a premium efficiency motor controlled by a variable frequency drive to improve system efficiency.

Exhaust: There are three roof mounted exhaust fans serving toilet rooms. These fans are manually controlled by maintenance staff. In addition to these exhaust fans, common exhaust for all other spaces is provided by the RTUs at a constant fixed volume matching the volume of outside air that is provided. The exhaust fans are in good condition.

Controls Systems

This building is also being upgraded with a new campus-wide BAS control system. The spaces are currently heated to 72°F occupied and 60°F unoccupied, and cooled to 76°F occupied and 85°F unoccupied. It is assumed that this new controls system will serve the needs of the facility and will operate effectively once installation is completed, therefore no controls related ECMs are being considered.

Domestic Hot Water Systems

Domestic hot water is created by a Rheem Ruud 50 gallon electric tank type water heater. DHW stored in this tank is maintained at 140°F and distributed to lavatories by a fractional

horsepower inline recirculation pump. This water heater is in good condition, but is expensive to operate as compared to a natural gas fired water heater.

An ECM has been included to replace this electric water heater with a natural gas-fired condensing tank type water heater.

Kitchen Equipment

There is no kitchen in this building.

Plug Load

This school has computers, LCD monitors, copiers, residential appliances (microwave, refrigerator), printers, portable electric heaters and air conditioners (personal) which contribute to the plug load in the building. An ECM has been included to reduce the power consumption of the personal computers via a network power control software.

Plumbing Systems

The plumbing fixtures in this building are all older and assumed to be original to building construction. The water closets consume an estimated 3.0 gallons per flush (GPF) each, the urinals consume an estimated 2.0 gallons per flush and the faucets flow 2.0 gallons per minute.

An ECM is included to evaluate the water savings potential of installing low- flow water closets, urinals and faucet aerators.

Lighting Systems

Lighting in this building consists of 4’ and 8’ linear fluorescent fixtures using a mixture of T-8 and T-12 lamps. These fixtures are all manually controlled by wall mounted switches.

Three lighting ECMs have been included which include adding occupancy sensors to the existing lighting, replacement of the T-8 lighting with LED lighting and a third ECM that evaluates the effect of occupancy sensors used with the LED lighting upgrades.

3.0 UTILITIES

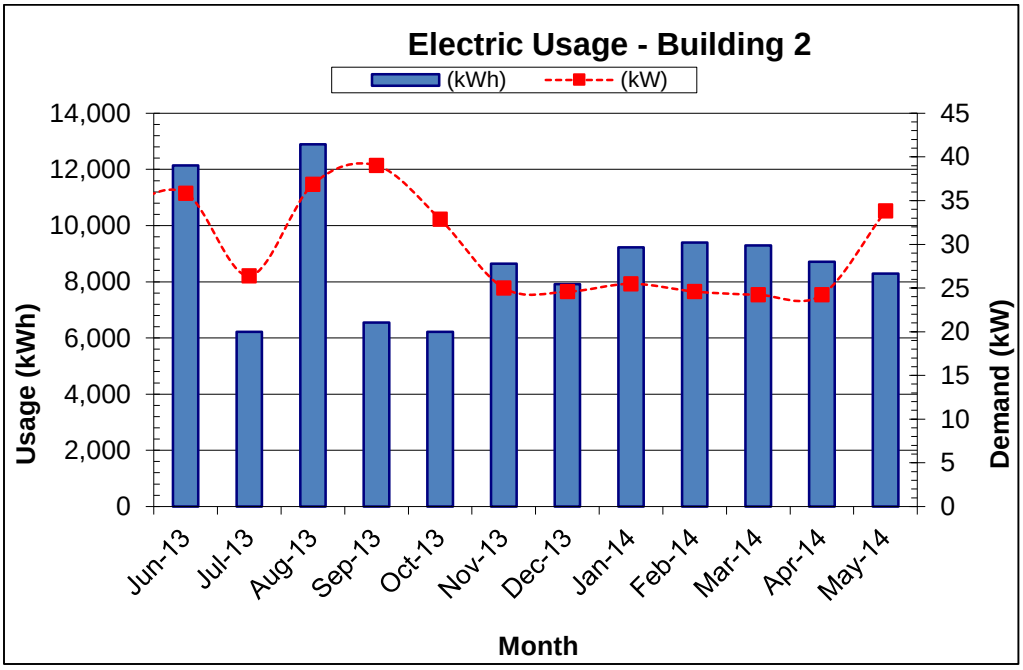
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	First Energy Solutions Corp.	New Jersey Natural Gas

For the 12-month period ending in May 2014, the utilities usages and costs for the building were as follows:

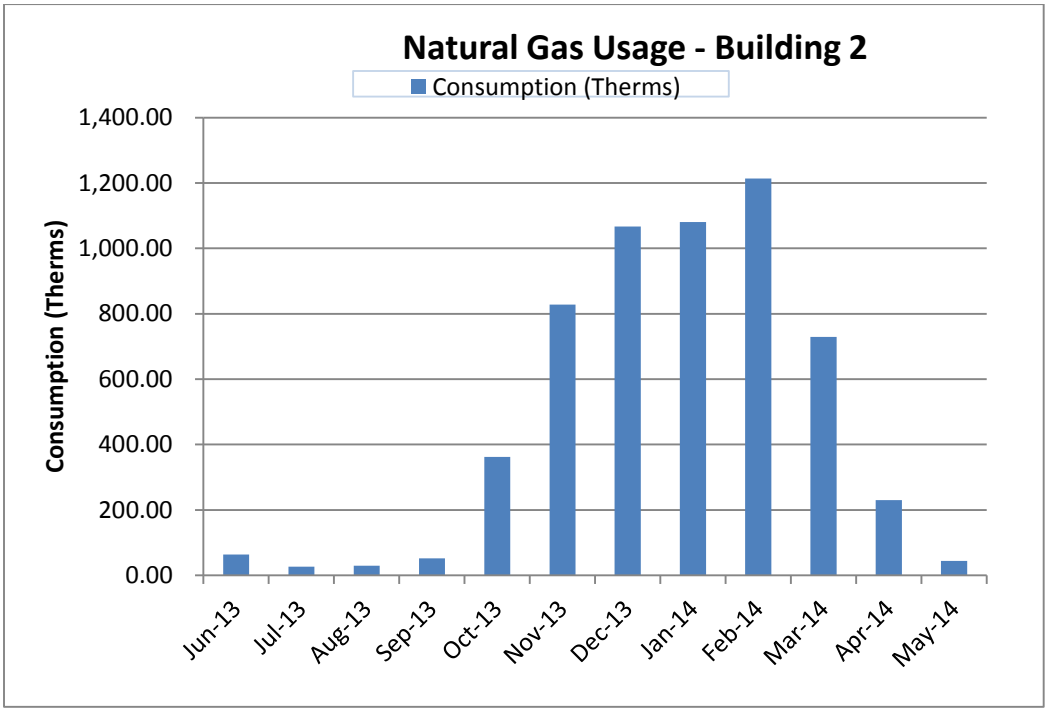
Electric		
Annual Consumption	113,651	kWh
Annual Cost	13,470	$
Blended Unit Rate	0.119	$/kWh
Supply Rate	0.091	$/kWh
Demand Rate	3.38	$/kW
Peak Demand	39.4	kW
Natural Gas		
Annual Consumption	5,726	Therms
Annual Cost	6,449	$
Unit Rate	1.126	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



The electric usage presented in the graph above shows consumption that is typical of an air conditioned school, with peak electrical consumption and demand associated with summer months when cooling is in operation. Usage and demand appear to be

low in the month of July, 2013 which may be the result of the school being mostly shut down during that month.



The natural gas consumption presented in the graph above is typical of a school building with peak consumption occurring during the winter months when the heating load is at it's highest. From the graph, it is easy to tell that the consumption during the summer is predominantly used for domestic water heating as the building is not being heated.

In addition, domestic water and sewer services are provided by the Township of Denville at $9.00/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.09	$0.13	N
Natural Gas	$/Therm	$0.94	$0.96	N
Fuel Oil	$/Gal	NA	$3.62	NA

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

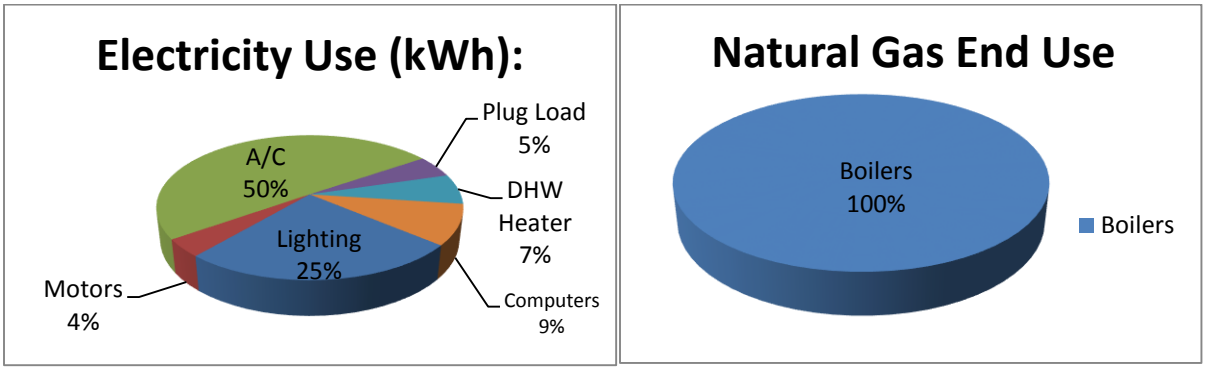
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

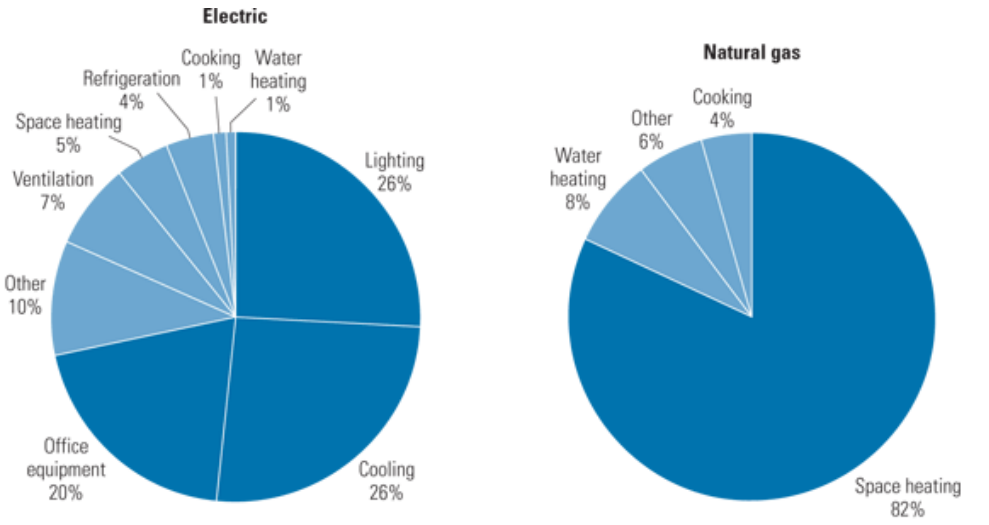
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
39	122.5	63

The school has an above average Energy Star Rating Score (50 being the median score), and is considered an energy efficient building. By implementing the recommended ECMs, the building EUI will decrease and the energy star score will increase. EPA Portfolio Manager data can be found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Replace Door Seals

The exterior doors have deteriorating sweeps and seals which allow for excessive building infiltration/exfiltration and increased heating and cooling loads. It is proposed to install new door sweeps and seals on all of the exterior doors to reduce this infiltration/exfiltration. Energy savings in the form of electricity and natural gas will result from this reduction of heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Replace Door Seals

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
922	0	202	126	0	166	1.7	0	5.6	5.6

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.2 ECM-2 Roof Replacement/Insulation Improvement

The roof on this building is in poor condition and is nearing the end of its useful life. In addition to the poor condition, this roof has only minimal insulation assumed to be 2". It is proposed to replace the existing rolled asphalt roof with an EPDM rubber membrane roof and install an additional 2" of roof insulation. Energy savings in the form of electricity and natural gas will result from increased insulation of the roof which will reduce the heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Roof Replacement/Insulation Improvement

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
320,563	0	448	1,729	0	2,001	(0.8)	0	160.2	160.2

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.3 ECM-3 Replace Boiler with Condensing Boiler

The existing boiler serving perimeter fin tube radiation and heating coils in RTUs is standard efficiency (approximately 80% efficient) and is nearing the end of its useful life. It is proposed to replace this boiler with a high efficiency condensing boiler. Condensing

boilers can operate at efficiencies of over 96% when in condensing mode. It is assumed that the proposed boiler will maintain a seasonal efficiency of 90% within the calculations. Natural gas savings will result from a higher overall system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-3 Replace Boiler with Condensing Boiler

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
51,554	0	0	1,248	0	1,406	(0.3)	1,750	36.7	35.4

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended based on the existing boiler reaching the end of its useful life.

5.4 ECM-4 Install HHW Pump VFDs & Premium Motors

The existing heating hot water (HHW) pump motor is standard efficiency (87.5%) and currently can only provide constant water flow to the system. It is proposed to replace this motor with premium efficiency (90.5%) motor and install a variable frequency drive (VFD) to allow for the pump to modulate water flow based on actual heating load requirements. Electrical energy savings will result from a higher efficiency motor as well as reduced motor power draw during lower flow times.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-4 Install HHW Pump VFDs & Premium Motors

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
3,888	0	9,410	0	0	1,129	3.4	460	3.4	3.0

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.5 ECM-5 Condensing Domestic Hot Water Heater

The existing domestic hot water heater is a 50 gallon electric tank type heater. This water heater is in good condition, however it is expensive to operate due to the high cost of electricity. It is proposed to replace this electric water heater with a natural gas-fired condensing water heater of the same storage capacity. Condensing water heaters operate at efficiencies above 96% year-round due to the low supply water temperature to the heaters. Cost savings will result from the lower cost of natural gas versus electricity.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-5 Condensing Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
9,127	25	8,047	(280)	0	1,474	3.7	50	6.2	6.2

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.6 ECM-6 Computer Network Controller

There are approximately 18 desktop computers used in classrooms and computer rooms in the building. These computers are generally left on when the spaces are unoccupied. Although there are sleep and/or hibernate functions built into the computers, there is more advanced computer network control software which will allow for the units to reduce standby electrical energy consumption even further when the computers are not in use. Electrical energy savings will result from lower standby power draw of the computers during unoccupied hours.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-6 Computer Network Controller

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
1,776	0	1,260	0	0	151	0.3	0	11.7	11.7

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.7 ECM-7 Install Low Flow Plumbing Fixtures

The plumbing fixtures in this building are older high flow fixtures. The water savings associated from replacing existing high flow fixtures with low-flow fixtures was calculated by taking the difference of the annual water usage for the proposed and base case. The basis of this calculation is the estimate usage of each fixture, gallons per use, and number of fixtures. Replacing the existing fixtures in the restrooms with 1.28 Gals/flush toilets, 1.0 gal/flush urinals, and 0.5 gpm aerators will conserve water which will result in lower annual water and sewer charges.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-7 Install Low Flow Plumbing Fixtures

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
23,368	0	933	0	82	849	0.1	0	27.5	27.5

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.8.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of mostly T8 linear fluorescent fixtures which until recently represented the most efficient lighting technology available. Exterior lighting includes 1000W wall mounted area light fixtures. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
38,819	6.0	17,341	0	1,816	(0.1)	7,050	21.4	17.5

* LED retrofits must go through the “custom” measures incentive option under New Jersey SmartStart Program. There are no “prescriptive” incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for “custom” incentives. See section 6.0 for other incentive opportunities

This measure is not recommended in lieu of ECM L3.

5.8.2 ECM-L2 Install Lighting Controls (Occupancy Sensors)

Presently, all interior lighting fixtures are controlled my wall mounted switches. Review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied.

This measure recommends installing occupancy sensors for the current lighting system. Using a process similar to that utilized in Section 5.7.1, the energy savings for this measure was calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L2 Install Lighting Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
6,210	0	7,142	0	857	1.1	805	7.2	6.3

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is not recommended in lieu of ECM L3.

5.8.3 ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

This measure is a combination of ECM-L1 and ECM-L2; recommending replace/upgrade the current lighting fixtures to more efficient ones and installing occupancy sensors on the new lights. Interactive effects of the higher efficiency lights and occupancy sensors lead the energy and cost savings for this measure to not be cumulative or equivalent to the sum of replacing the lighting fixtures alone and installing occupancy sensors without the lighting upgrade. The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
45,029	6.0	20,266	0	2,080	(0.1)	7,855	21.7	17.9

* LED retrofits must go through the “custom” measures incentive option under New Jersey SmartStart Program. There are no “prescriptive” incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for “custom” incentives. See section 6.0 for other incentive opportunities

This measure is recommended as the existing lighting system has reached the end of its useful life.

5.9 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Replace RTU filters before each season
- Purchase ENERGY STAR® Appliances
- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train custodians to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate students and staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.
- During the winter, Custodians should ensure all windows are closed as part of cleaning routine

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.05/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding

bonds or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. However there is insufficient space to implement a photovoltaic solar array on the roof.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

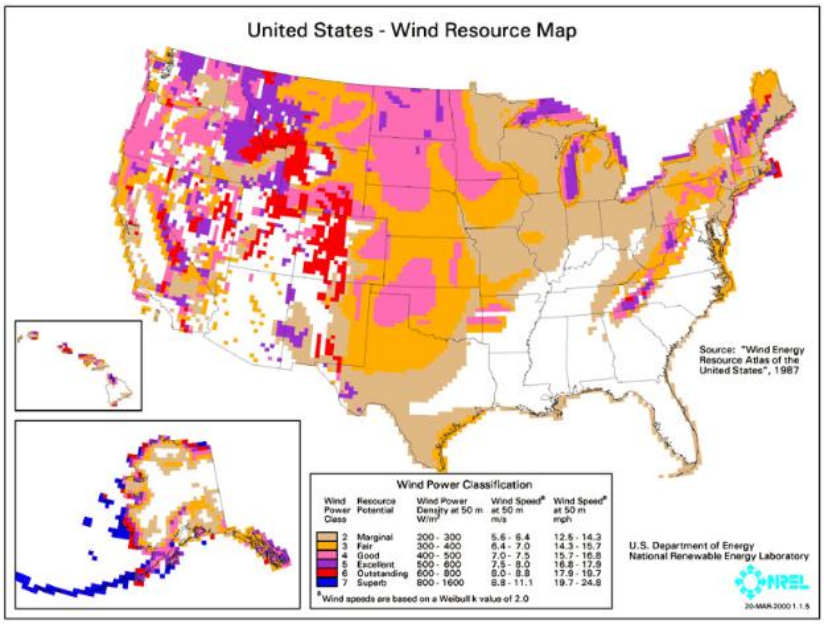
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development

Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

This school already participates in a demand response program.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building Name.

The following projects should be considered for implementation:

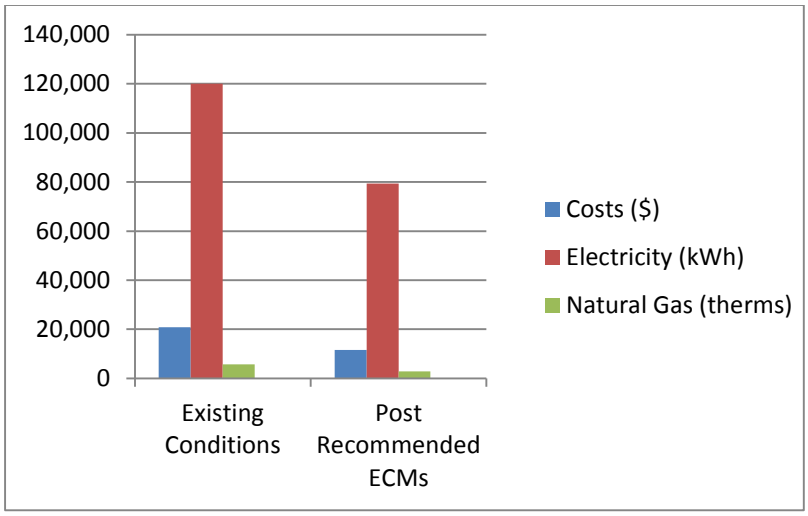
- Replace Door Seals
- Roof Replacement/Insulation Improvement
- Replace Boiler with Condensing Boiler
- Install HHW Pump VFD & Premium Motor
- Condensing Domestic Hot Water Heater
- Computer Network Controller
- Install Low Flow Plumbing Fixtures
- Lighting Replacements with Controls

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
40,566	2,823	9,255	48.2

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	19,919	10,664	46%
Electricity (kWh)	119,944	79,378	34%
Natural Gas (therms)	5,726	2,903	49%
Site EUI (kbtu/SF/Yr)	106.4	60.8	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 2
400 East Main Street, Denville, NJ 07834

Annual Utilities
12-month Summary

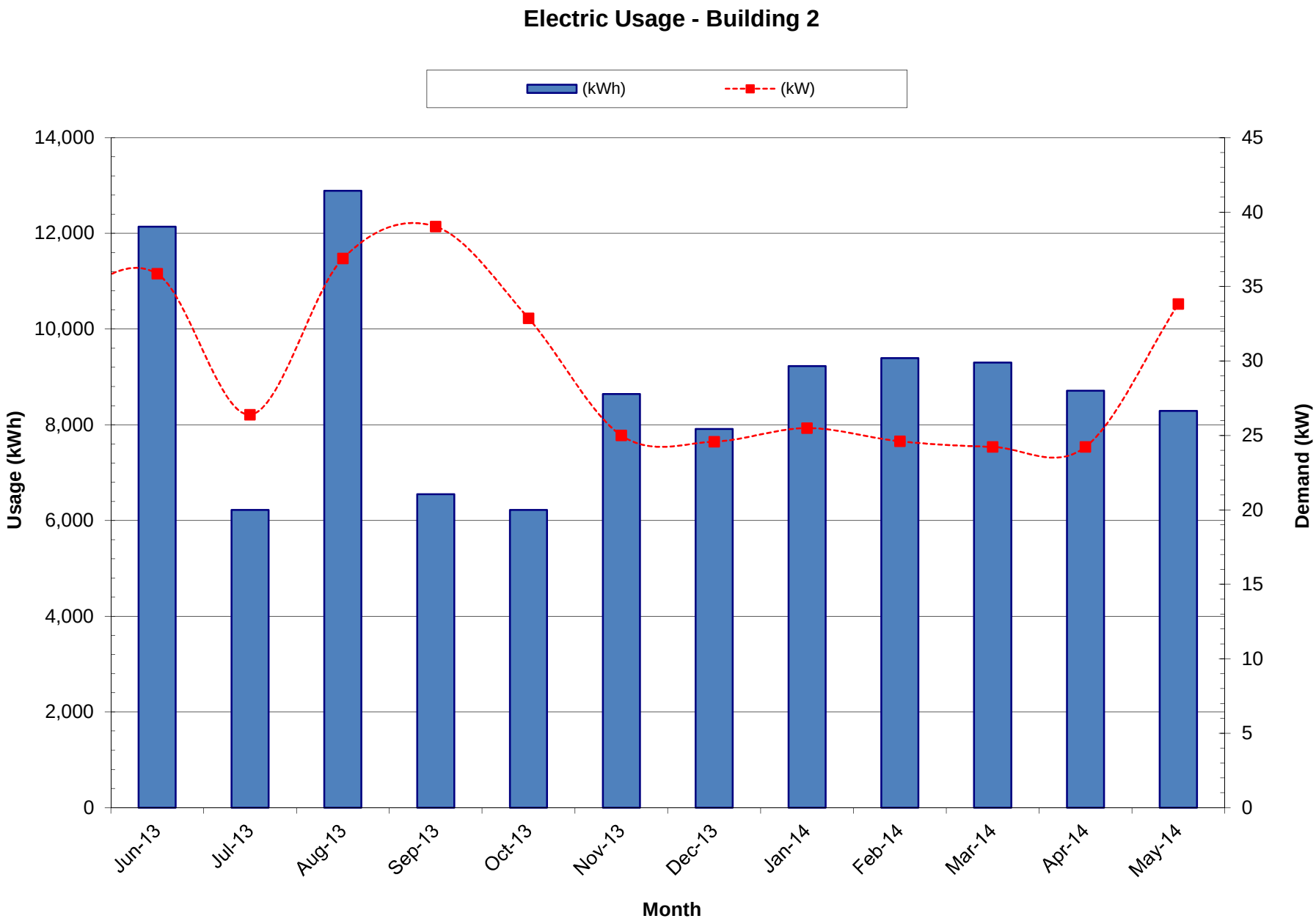
Electric		
Annual Usage	113,651	kWh/yr
Annual Cost	13,470	$
Blended Rate	0.119	$/kWh
Consumption Rate	0.091	$/kWh
Demand Rate	3.38	$/kW
Peak Demand	39.4	kW
Min. Demand	23.5	kW
Avg. Demand	29.7	kW
Natural Gas		
Annual Usage	5,726	Therms/yr
Annual Cost	6,449	$
Rate	1.126	$/therm
Water		
Annual Usage	820	kgal/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 2
400 East Main Street, Denville, NJ 07834

For Service at:	**Building 2**					
Account No.:	**100000077717**	**Delivery -**	JCP & L	Building Area	9,225	SF
Meter No.:	**L86699237**	**Supplier -**	First Energy Solutions Corp.	% of Total Area Served	7.3%	%
Electric Service						

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	**Consump. (kWh)**	**Demand (kW)**	**Delivery ($)**	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Blended Rate ($/kWh)**	**Consumption ($/kWh)**	**Demand ($/kW)**
May-12	7,350	33.8	1,181.18	0.00	950.59	715.82	234.77	0.13	0.10	6.94
June-12	8,547	39.4	1,332.55	0.00	1,332.55	1,058.98	273.57	0.16	0.12	6.94
July-12	6,223	25.7	950.59	0.00	950.59	772.50	178.09	0.15	0.12	6.94
August-12	9,956	29.4	383.34	0.00	383.34	179.18	204.16	0.04	0.02	6.94
September-12	6,951	39.0	378.32	0.00	378.32	125.83	252.48	0.05	0.02	6.47
October-12	8,266	34.3	370.00	0.00	370.00	147.90	222.10	0.04	0.02	6.47
November-12	7,585	25.0	297.92	0.00	297.92	136.16	161.75	0.04	0.02	6.47
December-12	8,970	25.3	316.02	0.00	316.02	157.71	158.31	0.04	0.02	6.25
January-13	8,712	23.5	301.44	0.00	301.44	149.23	152.21	0.03	0.02	6.47
February-13	9,651	24.8	324.98	0.00	324.98	164.74	160.24	0.03	0.02	6.47
March-13	8,031	27.4	315.54	0.00	315.54	137.97	177.56	0.04	0.02	6.47
April-13	8,383	27.6	322.40	0.00	322.40	143.79	178.61	0.04	0.02	6.47
May-13	8,148	33.8	375.01	651.04	1,026.04	791.28	234.77	0.13	0.10	6.94
June-13	12,140	35.9	454.99	969.99	1,424.98	1,176.15	248.82	0.12	0.10	6.94
July-13	6,223	26.4	286.51	497.19	783.70	0.00	178.09	0.13	0.00	6.75
August-13	12,891	36.9	474.54	1,030.03	1,504.57	1,248.61	255.95	0.12	0.10	6.94
September-13	6,551	39.0	366.40	523.46	889.85	637.37	252.48	0.14	0.10	6.47
October-13	6,223	32.9	248.75	497.19	745.94	604.17	141.77	0.12	0.10	4.31
November-13	8,641	25.0	310.69	690.43	1,001.12	839.37	161.75	0.12	0.10	6.47
December-13	7,913	24.6	292.78	632.28	925.05	766.01	159.05	0.12	0.10	6.47
January-14	9,228	25.5	310.10	737.34	1,047.44	882.50	164.94	0.11	0.10	6.47
February-14	9,393	24.6	306.84	750.47	1,057.32	898.13	159.19	0.11	0.10	6.47
March-14	9,299	24.2	302.99	742.97	1,045.96	889.19	156.77	0.11	0.10	6.47
April-14	8,712	24.2	294.10	696.07	990.16	833.39	156.77	0.11	0.10	6.47
May-14	8,289	33.8	366.02	662.29	1,028.32	793.55	234.77	0.12	0.10	6.94
Total (All)	**212,274**	**39.42**	**$10,863.99**	**$9,080.74**	**$19,714.14**	**$14,249.55**	**$4,858.98**	**$0.09**	**$0.07**	**$6.55**
Total (last 12-months)	**113,651**	**39.02**	**$10,863.99**	**$9,080.74**	**$13,470.46**	**$10,359.73**	**$2,505.12**	**$0.12**	**$0.09**	**$3.38**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)



Utility Data -Building 2.xlsx
Building 2 Graph

Building 2
400 East Main Street, Denville, NJ 07834

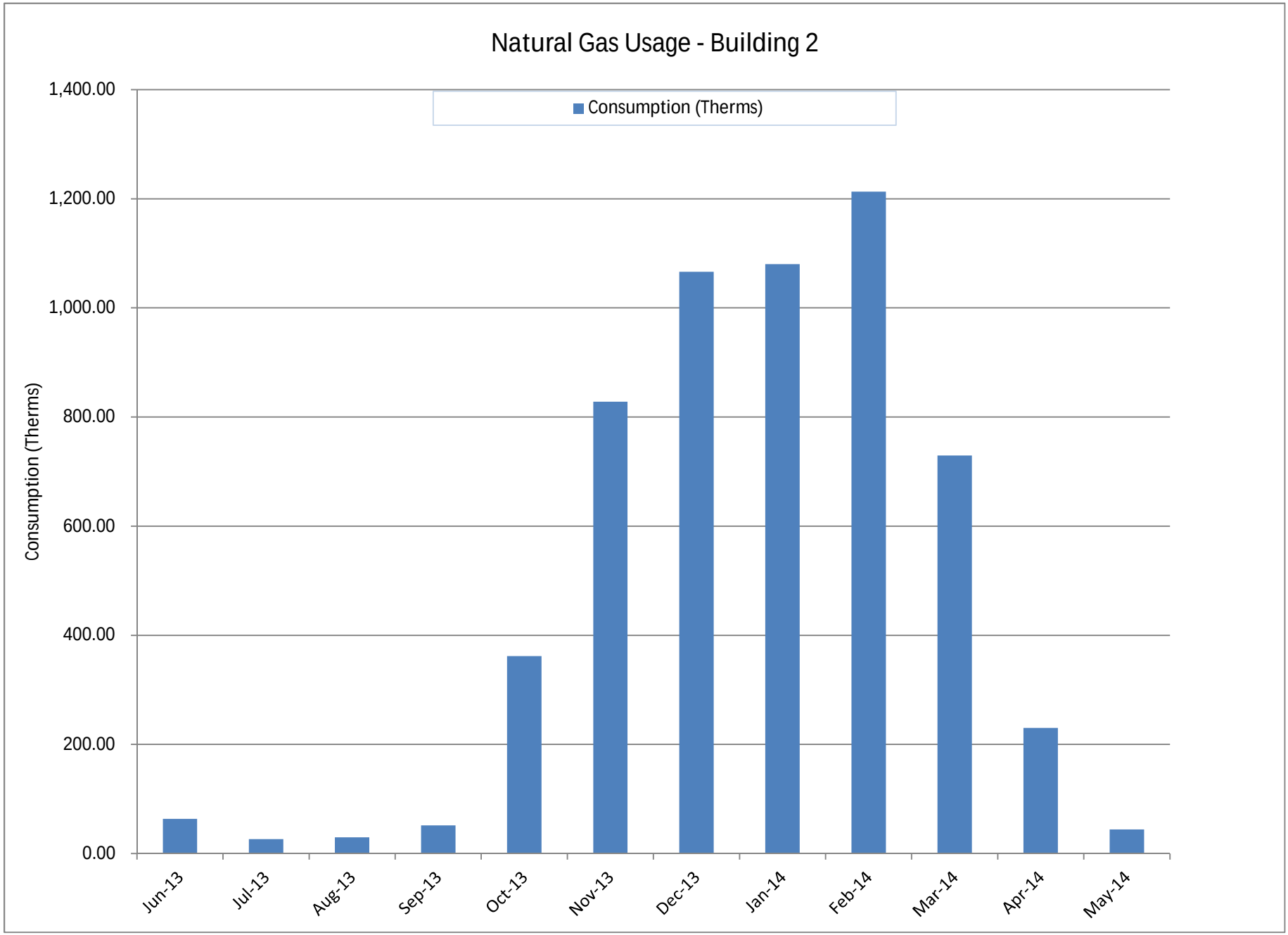
For Service at: **400 East Main Street, Denville, NJ 07834**
Account No.: **100000077717**
Meter No: **L86699237**
Natural Gas Service

Delivery - **New Jersey Natural Gas**
Supplier - **New Jersey Natural Gas**

Building 2 Consumption

Building Area 9,225 SF
% of Total Area Served 9.7% %

		Charges		Unit Costs	
Month	**Consumption (Therms)**	**Delivery ($)**	**Total ($)**	**Delivery ($/Therm)**	**Total ($/Therm)**
June-12	20.19	$ 53.85	$ 53.85	$ 2.667	$ 2.667
July-12	37.14	$ 138.02	$ 138.02	$ 3.716	$ 3.716
August-12	29.06	$ 88.56	$ 88.56	$ 3.047	$ 3.047
September-12	71.12	$ 121.09	$ 121.09	$ 1.703	$ 1.703
October-12	240.29	$ 272.28	$ 272.28	$ 1.133	$ 1.133
November-12	948.49	$ 929.37	$ 929.37	$ 0.980	$ 0.980
December-12	901.10	$ 902.18	$ 902.18	$ 1.001	$ 1.001
January-13	910.64	$ 899.65	$ 899.65	$ 0.988	$ 0.988
February-13	813.59	$ 804.03	$ 804.03	$ 0.988	$ 0.988
March-13	687.10	$ 691.13	$ 691.13	$ 1.006	$ 1.006
April-13	376.27	$ 424.36	$ 424.36	$ 1.128	$ 1.128
May-13	203.22	$ 265.81	$ 265.81	$ 1.308	$ 1.308
June-13	63.65	$ 127.38	$ 127.38	$ 2.001	$ 2.001
July-13	26.57	$ 90.09	$ 90.09	$ 3.391	$ 3.391
August-13	29.72	$ 92.42	$ 92.42	$ 3.110	$ 3.110
September-13	51.72	$ 113.68	$ 113.68	$ 2.198	$ 2.198
October-13	361.74	$ 405.83	$ 405.83	$ 1.122	$ 1.122
November-13	828.31	$ 851.54	$ 851.54	$ 1.028	$ 1.028
December-13	1,066.35	$ 1,074.66	$ 1,074.66	$ 1.008	$ 1.008
January-14	1,080.35	$ 1,104.25	$ 1,104.25	$ 1.022	$ 1.022
February-14	1,213.20	$ 1,252.02	$ 1,252.02	$ 1.032	$ 1.032
March-14	729.41	$ 876.37	$ 876.37	$ 1.201	$ 1.201
April-14	230.36	$ 348.12	$ 348.12	$ 1.511	$ 1.511
May-14	44.13	$ 112.29	$ 112.29	$ 2.545	$ 2.545
June-14	44.13	$ 112.29	$ 112.29	$ 2.545	$ 2.545
Total (12 Months)	**5,726**		**$ 6,448.65**		**$ 1.126**


Natural Gas Usage - Building 2
Consumption (Therms)
1,400.00
1,200.00
1,000.00
800.00
600.00
400.00
200.00
0.00
Consumption (Therms)
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

Back to main supplier information page

APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	Current year	Years Old	NJ Protocols life expectancy
RT-2.1	2	1	Trane	YHC092F3	142719564L	Packaged DX RTU with Gas Heat	7.5 Tons/120.0 MBH/ 3,600 SCFM	12.6 EER	Roof	Classrooms	2014	15		2014	0	15
RT-2.2	2	1	Trane	YHC060E3	142710502L	Packaged DX RTU with Gas Heat	5 Tons/64.0 MBH/ 2,400 SCFM	15.0 EER	Roof	Classrooms	2014	15		2014	0	15
RT-2.3	2	1	Trane	YHC092F3	142710570L	Packaged DX RTU with Gas Heat	7.5 Tons/120.0 MBH/ 3,600 SCFM	12.6 EER	Roof	Classrooms	2014	15		2014	0	15
RT-2.4	2	1	Trane	YHC048E3	142710467L	Packaged DX RTU with Gas Heat	5 Tons/64.0 MBH/ 1,920 SCFM	13.35 EER	Roof	Classrooms	2014	15		2014	0	15
RT-2.5	2	1	Trane	4YCC3018A1040BA	14263H0J9H	Packaged DX RTU with Gas Heat	1.5 Tons/32 MBH	13.0 SEER	Roof	Classrooms	2014	15		2014	0	15
RT-2.6	2	1	Trane	YHC092F3	142710576L	Packaged DX RTU with Gas Heat	7.5 Tons/120.0 MBH/ 3,600 SCFM	12.6 EER	Roof	Classrooms	2014	15		2014	0	15
Portable AC	2	1	Electrolux	FRA123PT1	KK41163836	Portable AC/ Electric	1 Ton	8.7 EER	Adult Education	Adult Education	2014	10		2014	0	10
HHW Boiler	2	1	HB Smith	19 Series-7	F93-86	HHW Boiler/ Natural Gas	942 MBH	80%	Boiler Room	Building 2 Perimeter Heat	1986	-3		2014	28	25
HHW Pump	2	1	Bell & Gossett	Not Accessible	Not Accessible	HHW Pump/ Electric	3 HP (estimated)	85%	Boiler Room	Building 2 Perimeter Heat	1986	-13		2014	28	15
DHW Heater	2	1	Rheem Ruud	ELD52-B	RR 0808D05315	DHW Heater/ Electric	12 kW, 50 Gallon	100%	Storage Room	Building 2 Toilet Rooms	2008	9		2014	6	15

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.55 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
182LED	Entrance Vestibule	Hallways	2	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.13	Breaker	2280	301	NONE	
182LED	Hallway	Hallways	26	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.72	SW	2280	3,912	NONE	
218LED	Janitor/Storage	Storage Areas	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.09	SW	1500	135	NONE	
192	208 Storage	Storage Areas	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.62	SW	1500	923	NONE	
41LED	208 Storage	Storage Areas	2	W 40 C F 2 (MAG)	F42SS	94	0.19	SW	1500	282	NONE	
40LED	Handicap Restroom	Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.06	SW	1500	90	C-OCC	
41LED	Boiler Room	Mechanical Room	1	W 40 C F 2 (MAG)	F42SS	94	0.09	SW	1500	141	NONE	
35LED	207 Superintendant of Adult Education	Classrooms	8	T 32 R F 3 (ELE)	F43ILL/2	90	0.72	SW	3200	2,304	C-OCC	
35LED	207 Superintendant of Adult Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
35LED	207 Superintendant of Adult Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
182LED	Room 205	Classrooms	18	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.19	SW	3200	3,802	C-OCC	
35LED	Adult Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
35LED	Adult Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
55LED	206 Career Center	Classrooms	4	2T 17 R F 3 (ELE)	F23ILL	47	0.19	SW	3200	602	C-OCC	
55LED	206 Career Center	Classrooms	4	2T 17 R F 3 (ELE)	F23ILL	47	0.19	SW	3200	602	C-OCC	
182LED	204/205 Common Room	Classrooms	3	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.20	SW	3200	634	C-OCC	
4LED	204/205 Common Room	Classrooms	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.14	SW	3200	461	C-OCC	
4LED	204/205 Storage	Storage Areas	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.07	SW	1500	108	NONE	
4LED	204/205 Storage	Storage Areas	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.07	SW	1500	108	NONE	
54LED	204/205 Restroom	Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1500	108	C-OCC	
182LED	Room 204	Classrooms	11	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.73	SW	3200	2,323	C-OCC	
4LED	Room 204	Classrooms	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.22	SW	3200	691	C-OCC	
35LED	Continuing Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
35LED	Continuing Education	Classrooms	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.18	SW	3200	576	C-OCC	
35LED	Continuing Education	Classrooms	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.45	SW	3200	1,440	C-OCC	
35LED	Continuing Education	Classrooms	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.45	SW	3200	1,440	C-OCC	
182LED	Room 203	Classrooms	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.59	SW	3200	1,901	C-OCC	
4LED	Room 203	Classrooms	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.14	SW	3200	461	C-OCC	
41LED	Room 203	Classrooms	3	W 40 C F 2 (MAG)	F42SS	94	0.28	SW	3200	902	C-OCC	
182LED	Room 202	Classrooms	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.59	SW	3200	1,901	C-OCC	
4LED	Room 202	Classrooms	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.22	SW	3200	691	C-OCC	
182LED	Mens Restroom	Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.07	SW	1500	99	NONE	
218LED	Mens Restroom	Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.09	SW	1500	135	NONE	
182LED	Womens Restroom	Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.07	SW	1500	99	NONE	
218LED	Womens Restroom	Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.09	SW	1500	135	NONE	

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: $0.090 $/kWh
$3.55 $/kW

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh			
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)		Retrofit control device	Notes

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.55 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide Equivalent	Building Area	Annual Utility Cost		
					Electric	Natural Gas	Fuel Oil
$ 0.120	$/kWh blended		0.000420205	9,225	$ 13,470	$ 6,449	$ -
$ 0.090	$/kWh supply	119,944	0.000420205				
$ 3.55	$/kW	39.4	0				
$ 1.13	$/Therm	5,726	0.00533471				
$ 9.00	$/kgals	2,000	0				
$ -	$/Gal	-					

Building 2

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO_2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Replace Door Seals	0.0	202	126	0	0	166	$ 922	5.6	15	0.8	$ -	N	5.6	0.0	3,028	1,885	0	$ 2,486	1.7	$1,056	16.0%
Y	ECM-2	Roof Replacement/Insulation Improvement	0.0	448	1,729	0	0	2,001	$ 320,563	160.2	25	9.4	$ -	N	160.2	0.0	11,197	43,233	0	$ 50,024	(0.8)	($285,720)	-11.1%
Y	ECM-3	Replace Boiler with Condensing Boiler	0.0	0	1,248	0	0	1,406	$ 51,554	36.7	25	6.7	$ 1,750	N	35.4	0.0	0	31,209	0	$ 35,142	(0.3)	($25,327)	-2.5%
Y	ECM-4	Install HHW Pump VFDs & Premium Efficiency Motors	0.0	9,410	0	0	0	1,129	$ 3,888	3.4	15	4.0	$ 460	N	3.0	0.0	141,151	0	0	$ 16,938	3.4	$10,052	32.5%
Y	ECM-5	Condensing Domestic Hot Water Heater	25.0	8,047	(280)	0	0	1,474	$ 9,127	6.2	25	1.9	$ 50	N	6.2	625.0	201,178	(7,009)	0	$ 42,874	3.7	$16,582	15.8%
Y	ECM-6	Computer Network Controller	0.0	1,260	0	0	0	151	$ 1,776	11.7	15	0.5	$ -	N	11.7	0.0	18,900	0	0	$ 2,268	0.3	$29	3.2%
Y	ECM-7	Install Low Flow Plumbing Fixtures	0.0	933	0	0	82	849	$ 23,368	27.5	30	0.4	$ -	N	27.5	0.0	27,985	0	2,457	$ 25,474	0.1	($6,724)	0.6%
N	ECM-L1	Lighting Replacements / Upgrades	6.0	17,341	0	0	0	1,816	$ 38,819	21.4	15	7.3	$ 7,050	N	17.5	90.0	260,115	0	0	$ 35,048	(0.1)	($10,086)	-1.9%
N	ECM-L2	Install Lighting Controls (Add Occupancy Sensors)	0.0	7,142	0	0	0	857	$ 6,210	7.2	15	3.0	$ 805	N	6.3	0.0	107,130	0	0	$ 12,856	1.1	$4,826	13.5%
Y	ECM-L3	Lighting Replacements with Controls (Occupancy Sensors)	6.0	20,266	0	0	0	2,080	$ 45,029	21.7	15	8.5	$ 7,855	N	17.9	90.0	303,990	0	0	$ 40,313	(0.1)	($12,349)	-2.1%
		Total (Not Including [B] Option ECMs or L1, L2)	**31.0**	**40,566**	**2,823**	**0**	**82**	**$ 9,255**	**$ 456,226**	**49.3**	**20.6**	**32**	**$ 10,115**		**48.2**	**715**	**707,428**	**69,318**	**2,457**	**$215,518**	**(0.5)**	**($308,421)**	**-7.2%**
		Recommended Measures (highlighted green above)	**31.0**	**40,566**	**2,823**	**0**	**82**	**$ 9,255**	**$ 456,226**	**49.3**	**20.6**	**32**	**$ 10,115**	**0**	**48.2**	**715**	**707,428**	**69,318**	**2,457**	**$215,518**	**(0.5)**	**($308,421)**	**-7.2%**
		% of Existing	**79%**	**33.82%**	**49.30%**	**0**	**0.0409544**																

	City:	Newark, NJ				
	Occupied Hours/Week	70	70	70	70	50
		Building Operating	Auditorium Occupied	Gymnasium Occupied	Library Occupied	Classrooms Occupied
Temp	Enthalpy h (Btu/lb) / Bin Hours	Hours	Hours	Hours	Hours	Hours
102.5						
97.5	35.4 / 6	3	3	3	3	2
92.5	37.4 / 31	13	13	13	13	9
87.5	35.0 / 131	55	55	55	55	39
82.5	33.0 / 500	208	208	208	208	149
77.5	31.5 / 620	258	258	258	258	185
72.5	29.9 / 664	277	277	277	277	198
67.5	27.2 / 854	356	356	356	356	254
62.5	24.0 / 927	386	386	386	386	276
57.5	20.3 / 600	250	250	250	250	179
52.5	18.2 / 730	304	304	304	304	217
47.5	16.0 / 491	205	205	205	205	146
42.5	14.5 / 656	273	273	273	273	195
37.5	12.5 / 1,023	426	426	426	426	304
32.5	10.5 / 734	306	306	306	306	218
27.5	8.7 / 334	139	139	139	139	99
22.5	7.0 / 252	105	105	105	105	75
17.5	5.4 / 125	52	52	52	52	37
12.5	3.7 / 47	20	20	20	20	14
7.5	2.1 / 34	14	14	14	14	10
2.5	1.3 / 1	0	0	0	0	0
-2.5						
-7.5						

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

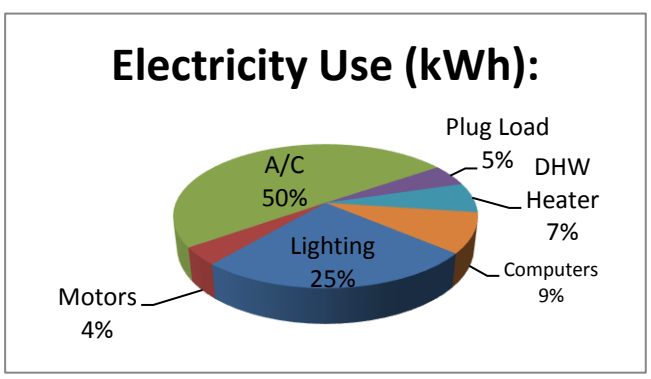
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

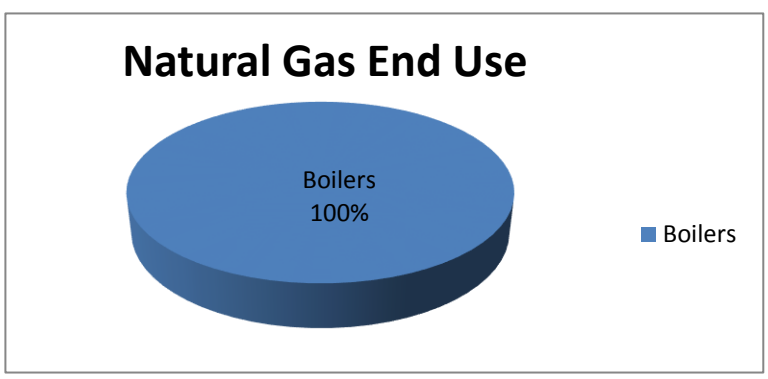
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
119,944	Total	Based on utility analysis	
30,186	Lighting	From Lighting Calculations	0.251667445
4,742	Motors	Estimated	0.039533235
60,255	A/C	See Window AC Calculation	0.502357714
5,914	Plug Load	Estimated	0.049306343
8,047	DHW Heater	Estimated	0.067090489
10,800	Computers	Estimated	0.09004202
Natural Gas Use (Therms):		**Notes/Comments:**	
5,726	Total	Based on utility analysis	
5,726	Boilers	Therms/SF x Square Feet Served	1





Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

ECM-1: Install Door Seals

Description: This ECM evaluates the thermal and electrical savings associate with adding door seals and sweeps to prevent infiltration of cold (hot) outdoor air.

Heating System Efficiency	80%		Ex Occupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Cooling System Efficiency	1.20	kW/ton	Ex Unoccupied Clng Temp.	72	*F	Ex Unoccupied Htg Temp.	72	*F
Linear Feet of Door Edge	52	LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.12	$/kWh
Existing Infiltration Factor*	1.5	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.13	$/therm
Proposed Infiltration Factor*	0.45	cfm/LF						

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	0.0	0	0	0	9,653	9,653	2,896	2,896	0	0	0	0
97.5	35.4	6	3	4	-2,775	-2,775	-833	-833	2	0	0	0
92.5	37.4	31	13	18	-3,476	-3,476	-1,043	-1,043	11	3	0	0
87.5	35.0	131	55	76	-2,627	-2,627	-788	-788	34	10	0	0
82.5	33.0	500	208	292	-1,947	-1,947	-584	-584	97	29	0	0
77.5	31.5	620	258	362	-1,421	-1,421	-426	-426	88	26	0	0
72.5	29.9	664	277	387	-844	-844	-253	-253	56	17	0	0
67.5	27.2	854	356	498	379	379	114	114	0	0	4	1
62.5	24.0	927	386	541	800	800	240	240	0	0	9	3
57.5	20.3	600	250	350	1,221	1,221	366	366	0	0	9	3
52.5	18.2	730	304	426	1,643	1,643	493	493	0	0	15	4
47.5	16.0	491	205	286	2,064	2,064	619	619	0	0	13	4
42.5	14.5	656	273	383	2,485	2,485	746	746	0	0	20	6
37.5	12.5	1,023	426	597	2,906	2,906	872	872	0	0	37	11
32.5	10.5	734	306	428	3,327	3,327	998	998	0	0	31	9
27.5	8.7	334	139	195	3,749	3,749	1,125	1,125	0	0	16	5
22.5	7.0	252	105	147	4,170	4,170	1,251	1,251	0	0	13	4
17.5	5.4	125	52	73	4,591	4,591	1,377	1,377	0	0	7	2
12.5	3.7	47	20	27	5,012	5,012	1,504	1,504	0	0	3	1
7.5	2.1	34	14	20	5,433	5,433	1,630	1,630	0	0	2	1
2.5	1.3	1	0	1	5,855	5,855	1,756	1,756	0	0	0	0
-2.5	0.0	0	0	0	6,276	6,276	1,883	1,883	0	0	0	0
-7.5	0.0	0	0	0	6,697	6,697	2,009	2,009	0	0	0	0
TOTALS		**8,760**	**3,650**	**5,110**					**288**	**87**	**179**	**54**

Existing Door Infiltration	**78**	**cfm**	**Savings**	**126**	**therms**	**$ 141**
Existing Unoccupied Door Infiltration	**78**	**cfm**		**202**	**kWh**	**$ 24**
Proposed Door Infiltration	**23**	**cfm**				**$ 166**
Proposed Unoccupied Door Infiltration	**23**	**cfm**				

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
1	3	7	20	0.125	all sides	13	65%	0.08125
2	3	7	20	0.125	all sides	13	65%	0.08125
3	3	7	20	0.125	all sides	13	65%	0.08125
4	3	7	20	0.125	all sides	13	65%	0.08125
Total	**12**	**28**	**80**	**0.125**		**52**	**65%**	**0.081**

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Install Door Seals - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Weatherization Seals & Sweeps	4	EA	$ 40	$ 115	$ -	$ 164	$ 573	$ -	$ 737	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 737	Subtotal
$ 184	25% Contingency
$ 922	**Total**

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

ECM-2 Install Additional Roof Insulation and Install New EPDM Roof

Existing: The existing roof has minimal tapered insulation which results in increased energy consumption due to heat gain/loss.
Proposed: Install 3" of additional rigid tapered insulation under new EPDM roof to reduce heat transfer.

Area of roof	10,000	SF	Cooling System Efficiency	1.20	kW/ton	Heating System Efficiency	80%	
Existing Infiltration Factor	**0.03**	**cfm/SF**	Ex Occupied Clng Temp.	72	*F	Heating On Point	55	*F
Proposed Infiltration Factor	**0.02**	**cfm/SF**	Ex Unoccupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Existing U Value	**0.101**	**Btuh/SF/°F**	Cooling Occ Enthalpy Setpoint	28.26	Btu/lb	Ex Unoccupied Htg Temp.	72	*F
Proposed U Value	**0.048**	**Btuh/SF/°F**	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.120	$/kWh
						Natural Gas	$ 1.13	$/Therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	41.1	0.0	0.0	0.0	-48,091	-49,117	-23,203	-23,716	0	0	0	0
97.5	40.8	1.0	1.0	0.0	-42,674	-43,700	-20,632	-21,145	4	2	0	0
92.5	41.7	7.0	7.0	0.0	-38,757	-39,783	-18,812	-19,325	27	13	0	0
87.5	39.3	45.0	45.0	0.0	-30,545	-31,571	-14,844	-15,357	137	67	0	0
82.5	34.5	175.0	175.0	0.0	-18,957	-19,983	-9,188	-9,701	332	161	0	0
77.5	31.5	312.0	312.0	0.0	-9,911	-10,937	-4,803	-5,316	309	150	0	0
72.5	29.0	404.0	404.0	0.0	-1,495	-2,521	-733	-1,246	60	30	0	0
67.5	27.4	725.0	725.0	0.0	0	0	0	0	0	0	0	0
62.5	24.6	862.0	862.0	0.0	0	0	0	0	0	0	0	0
57.5	21.6	824.0	824.0	0.0	0	0	0	0	0	0	0	0
52.5	19.2	674.0	674.0	0.0	25,982	25,982	12,452	12,452	0	0	219	105
47.5	16.7	530.0	530.0	0.0	32,645	32,645	15,645	15,645	0	0	216	104
42.5	14.8	750.0	750.0	0.0	39,307	39,307	18,838	18,838	0	0	369	177
37.5	12.6	908.0	908.0	0.0	45,969	45,969	22,031	22,031	0	0	522	250
32.5	10.7	890.0	890.0	0.0	52,631	52,631	25,224	25,224	0	0	586	281
27.5	8.9	580.0	580.0	0.0	59,293	59,293	28,417	28,417	0	0	430	206
22.5	7.2	392.0	392.0	0.0	65,955	65,955	31,609	31,609	0	0	323	155
17.5	5.5	339.0	339.0	0.0	72,617	72,617	34,802	34,802	0	0	308	147
12.5	3.9	243.0	243.0	0.0	79,280	79,280	37,995	37,995	0	0	241	115
7.5	2.5	77.0	77.0	0.0	85,942	85,942	41,188	41,188	0	0	83	40
2.5	1.3	20.0	20.0	0.0	92,604	92,604	44,381	44,381	0	0	23	11
-2.5	0.5	2.0	2.0	0.0	99,266	99,266	47,574	47,574	0	0	2	1
-7.5	0.3	0.0	0.0	0.0	105,928	105,928	50,767	50,767	0	0	0	0
TOTALS		**8,760**	**8,760**	**0**					870	422	**3,321**	**1,592**

Existing Roof Infiltration	**300**	**cfm**
Existing Roof Heat Transfer	**1,008**	**Btuh/°F**
Proposed Roof Infiltration	**150**	**cfm**
Proposed Roof Heat Transfer	**477**	**Btuh/°F**

Savings	**1,729**	**Therm**	**$ 1,947**
	448	**kWh**	**$ 54**
			$ 2,001

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

ECM-2 Install Additional Roof Insulation and Install New EPDM Roof - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Existing Roof Removal	10000	SF	$ -	$ -	$ 2.25	$ -	$ -	$ 25,290	$ 25,290	RS Means 2012
3" Additional Rigid Tapered Insulation	10000	SF	$ 0.98	$ 0.48	$ -	$ 10,065	$ 5,981	$ -	$ 16,045	RS Means 2012
EPDM Roof Membrane	10000	SF	$ 12.00	$ 6.25	$ 0.69	$ 123,240	$ 77,875	$ 7,756	$ 208,871	RS Means 2012
Equipment Re-Installation (RTUs)	1	LS	$ 2,500	$ 2,500	$ 500	$ 2,568	$ 3,115	$ 562	$ 6,245	RS Means 2013

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 256,451	Subtotal
$ 64,113	25% Contingency
$ 320,563	**Total**

Morris County Vocational Technical School District LGEA
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Building 2

ECM-3: Boiler Replacement

Description: This ECM evaluates the replacement of an existing standard efficiency cast iron sectional boiler with high efficiency condensing gas boiler. The existing boiler efficiency is 80% (per NJBPU protocols) and the proposed boiler efficiency is 90% (average seasonal efficiency). Electrical power consumption due to pumps is considered to be the same for both the proposed system and the baseline system.

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.13	/ Therm	Natural Gas
Baseline Fuel Cost		/ Gal	No. 2 Oil
FORMULA CONSTANTS			
Oversize Factor	0.8		
Hours per Day	24		
Design Outdoor Temp	14	F	
Infrared Conversion Factor	1.0		1.0 if Boiler, 0.8 if Infrared Heater
EXISTING			
Capacity	942,000	btu/hr	
Heating Combustion Efficiency	80%		
Heating Degree-Day	2,783	Degree-day	
Design Temperature Difference	56	F	
Fuel Conversion	100,000	btu/therm	
PROPOSED			
Capacity	942,000	btu/hr	
Efficiency	90%		
SAVINGS			
Fuel Savings	1,248	Therms	NJ Protocols Calculation
Fuel Cost Savings	$ 1,406		

Savings calculation formulas are taken from NJ Protocols document for Occupancy Controlled Thermostats

Algorithms

$$Gas\ Savings\ (Therms) = \frac{OF \times ((CAPY_{Bi} \times EFF_Q) - (CAPY_{Qi} \times EFF_B \times ICF)) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_B \times ICF \times EFF_Q}$$

Definition of Variables

OF = Oversize factor of standard boiler or furnace (OF=0.8)

$CAPY_{Bi}$ = Total input capacity of the baseline furnace, boiler or heater in Btu/hour

$CAPY_{Qi}$ = Total input capacity of the qualifying furnace, boiler or heater in Btu/hour

HDD_{mod} = HDD by zone and building type

24 = Hours/Day

ΔT = design temperature difference

HC_{fuel} = Conversion from Btu to therms of gas or gallons of oil or propane (100,000 btu/therm; 138,700 btu/gal of #2 oil; 92,000 btu/gal of propane)

EFF_Q = Efficiency of qualifying heater(s) (AFUE %)

EFF_B = Efficiency of baseline heaters (AFUE %)

ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for furnaces/boilers)[2]

Furnaces and Boilers

Component	Type	Value	Source
$AFUE_q$	Variable		Application
$AFUE_b$	Fixed	Furnaces: 78% Boilers: 80% Infrared: 78%	EPACT Standard for furnaces and boilers
$CAPY_{in}$	Variable		Application
ΔT	Variable	See Table Below	1
HDD_{mod}	Fixed	See Table Below	1

Sources:

1. KEMA, *Smartstart Program Protocol Review*. 2009.
2. http://www.spaceray.com/1_space-ray_faqs.php

Adjusted Heating Degree Days by Building Type

Building Type	Heating Energy Density (kBtu/sf)	Degree Day Adjustment Factor	Atlantic City (HDD)	Newark (HDD)	Philadelphia (HDD)	Monticello (HDD)
Education	29.5	0.55	2792	2783	2655	3886
Food Sales	35.6	0.66	3369	3359	3204	4689
Food Service	39.0	0.73	3691	3680	3510	5137
Health Care	53.6	1.00	5073	5057	4824	7060
Lodging	15.0	0.28	1420	1415	1350	1976
Retail	29.3	0.55	2773	2764	2637	3859
Office	28.1	0.52	2660	2651	2529	3701
Public Assembly	33.8	0.63	3199	3189	3042	4452
Public Order/Safety	24.1	0.45	2281	2274	2169	3174
Religious Worship	29.1	0.54	2754	2745	2619	3833
Service	47.8	0.89	4524	4510	4302	6296
Warehouse/Storage	20.2	0.38	1912	1906	1818	2661

Heating Degree Days and Outdoor Design Temperature by Zone

Weather Station	HDD	Outdoor Design Temperature (F)
Atlantic City	5073	13
Newark	5057	14
Philadelphia, PA	4824	15
Monticello, NY	7060	8

Morris County Vocational Technical School District LGEA
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ECM-3: Boiler Replacement - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
1,000 MBH NG Condensing Boiler	1	EA	$ 20,000	$ 7,500		$ 20,540	$ 9,345	$ -	$ 29,885	Vendor Estimate
Flue Installation	1	EA	$2,500.0	$2,500.00		$ 2,568	$ 3,115	$ -	$ 5,683	Vendor Estimate
Controls	1	EA	$ 100.0	$ 500.00		$ 103	$ 623	$ -	$ 726	RS Means 2012
Miscellaneous Electrical	1	LS	$ 1,000	$ 500		$ 1,027	$ 623	$ -	$ 1,650	RS Means 2012
Miscellaneous HW Piping	1	LS	$ 2,000	$ 1,000		$ 2,054	$ 1,246	$ -	$ 3,300	RS Means 2012
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 41,243	Subtotal
$ 10,311	25% Contingency
$ 51,554	**Total**

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Building 2

ECM-4: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives

Description: This ECM evaluates the energy (electrical) savings associated with replacing existing motors with high efficiency motors (based on ASHRAE 2010 NEMA ratings) and adding variable frequency drives to control motor speed based on actual load verses constant volume / constant flow.

Variable Inputs

Electric Rate	$0.12	**$/kWh**
Demand Rate	$0.09	**$/kW**

MOTOR SCHEDULE										Savings Factor		Existing Motor Energy		Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty	HP	Total HP	Upgrade Motor	Load Factor	Existing Motor Eff.	New Motor Eff.	Annual Hours	Demand Savings Factor	Energy Savings Factor	Demand Energy (kW)	Electrical Energy (kWh)	Demand Energy (kW)	Electrical Energy (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
HHWP	CHW/HW	1	5.0	5.0	Y	0.75	87.5%	90.5%	4,427	0.201	0.580	3.2	14,152	0.6	4,742	2.6	9,410
															Total:	2.6	9,410.1
																$ -	$ 1,129
																	$ 1,129

Savings calculation formulas are taken from NJ Protocols document for VFDs

Morris County Vocational Technical School District LGEA
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Building 2

ECM-4: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.00

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
5.0 HP VFD	1	ea	$ 1,706	$ 431	$ -	$ 1,752	$ 536	$ -	$ 2,289	RS Means 2012
5.0 HP Motor	1	ea	$ 373	$ 79	$ -	$ 383	$ 98	$ -	$ 481	RS Means 2012
Electrical - misc.	1	ls	$ 150	$ 150	$ -	$ 154	$ 187	$ -	$ 341	RS Means 2012
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 3,111	Subtotal
$ 778	25% Contingency
$ 3,888	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District LGEA
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Building 2

ECM-5: Replace Electric DHW Heater Condensing Gas-Fired DHW Heater

Description: This ECM evaluates the energy savings associated with replacing an electric tank type water heater with a high efficiency natural gas fired water heater.

Item	Value	Units	Formula/Comments
Occupied days per week	5	days/wk	
Occupied weeks per year	52	week/yr	
Water supply Temperature	55	˚F	Termperature of water coming into building
Hot Water Temperature	140	˚F	
Hot Water Usage per day	113	gal/day	Calculated from usage below
Annual Hot Water Energy Demand	20,710	MBTU/yr	Energy required to heat annual quantity of hot water to setpoint
Existing Tank Size	50	Gallons	Per manufacturer nameplate
Hot Water Temperature	140	˚F	Per building personnel
Average Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.7	MBH	
Annual Standby Hot Water Load	6,205	MBTU/yr	
Total Annual Hot Water Demand (w/ standby losses)	26,915	Mbtu/yr	Building demand plus standby losses
Existing Water Heater Efficiency	98%		Per Manufacturer
Total Annual Energy Required	27,465	Mbtu/yr	
Total Annual Electric Required	**8,047**	**kWh/yr**	**Electrical Savings**
Average Annual Electric Demand	0.92	kW	
Peak Electric Demand	**25.00**	**kW**	**Per Manufacturer's Nameplate (Demand Savings)**
New Tank Size	50	Gallons	
Hot Water Temperature	140	˚F	
Average Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.7	MBH	
Annual Standby Hot Water Load	6,205	MBTU/yr	
Prop Annual Hot Water Demand (w/ standby losses)	26,915	MBTU/yr	
Proposed Avg. Hot water heater efficiency	96%		Based on AO Smith Cyclone condensing DHW Heater
Proposed Total Annual Energy Required	28,037	MBTU/yr	
Proposed Fuel Use	280	Therms/yr	Standby Losses and inefficient DHW heater eliminated
Elec Utility Demand Unit Cost	$3.55	$/kW	
Elec Utility Supply Unit Cost	$0.09	$/kWh	
NG Utility Unit Cost	$1.13	$/Therm	
Existing Operating Cost of DHW	$1,789	$/yr	
Proposed Operating Cost of DHW	$316	$/yr	
Annual Utility Cost Savings	**$1,474**	**$/yr**	

Daily Hot Water Demand

			#USES PER DAY		FULL TIME OCCUPANTS**				
FIXTURE	*BASE WATER USE GPM	DURATION OF USE (MIN)	MALE	FEMALE	MALE	FEMALE	TOTAL GAL/DAY	% HOT WATER	TOTAL HW GAL/DAY
LAVATORY (Low-Flow Lavs use 0.5 GPM)	2.5	0.5	3	3	20	20	150	75%	113
SHOWER	2.5	5	1	1	0	0	0	75%	0
KITCHEN SINK	2.5	0.5	1	1	0	0	0	75%	0
MOP SINK	2.5	2	1	1	0	0	0	75%	0
Dishwasher (gal per use)	10	1	1	0	0	0	0	100%	0
						TOTAL	150		**113**

*GPM is per standard fixtures, adjust as necessary if actual GPM is known.
**These are the occupanct that use the fixtures. If fixture does not exist change to (0).

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ECM-5: Replace Electric DHW Heater Condensing Gas-Fired DHW Heater - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Electric DHW Heater Removal	1	LS		$ 50		$ -	$ 62	$ -	$ 62	RS Means 2012
High Efficiency Gas-Fired DHW Heater	1	EA	$ 4,000	$ 280		$ 4,108	$ 349	$ -	$ 4,457	RS Means 2012
Miscellaneous Electrical	1	LS	$ 300	$ 300		$ 308	$ 374	$ -	$ 682	RS Means 2012
Venting Kit	1	EA	$ 450	$ 650		$ 462	$ 810	$ -	$ 1,272	RS Means 2012
Miscellaneous Piping and Valves	1	LS	$ 200	$ 500		$ 205	$ 623	$ -	$ 828	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 7,302	Subtotal
$ 1,825	25% Contingency
$ 9,127	**Total**

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Building 2

ECM-6: Computer Network Controller Savings Calculations

Notes:

1. This ECM calculates the saving associated with the installation of a centralized computer management software installed on the client server that will cause the copmuters to hibernate and sleep during times of low or no usage.
2. Energy savings per computer are based on manuafactures historical information from previous installations

3. There are approximately 18 computers used in this building

Background Data **Average Consumption and Savings Figures**	**kWh**
Average Total Consumption per PC per Year	500-700
Average Energy and Cost Waste per PC per Year	350-450
Average savings per PC	70
Average savings per IMac	50

Number of PCs	18
Number of IMac's	0
Return on Investment Analysis	
	kWh
Annual Energy Savings	1,260
Total network controller software package cost	$1,776

Morris County Vocational Technical School District LGEA
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Building 2

ECM-6: Computer Network Controller Savings Calculations - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Computer Network Controller Software	1	LS	$ 625	$ 625	$ -	$ 642	$ 779	$ -	$ 1,421	Vendor Estimation
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,421	Subtotal
$ 355	25% Contingency
$ 1,776	**Total**

Morris County Vocational Technical School District LGEA
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Building 2

ECM-7: Replace urinals and flush valves with low flow

Description: This ECM evaluates the water savings associated with replacing/ upgrading urinals with 0.125 GPF urinals and or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Urinals in Building to be replaced	2	
Average Flushes / Urinal (per Day)	10	Based on # of occupants
Average Gallons / Flush	2.0	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	2	
Proposed Gallons / Flush	0.125	Gal
Proposed Material Cost of new urinal & valve	$1,200	RS Means 2012
Proposed Installation Cost of new urinal & valve	$1,000	RS Means 2012
Total cost of new urinals & valves		

SAVINGS		
Current Urinal Water Use	14.60	kGal / year
Proposed Urinal Water Use	0.91	kGal / year
Water Savings	13.69	kGal / year
Cost Savings	$123	/ year

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District LGEA
CHA Project Number: 28950
Building 2

ECM-7: Replace toilets and flush valves with low flow

Description: This ECM evaluates the water savings associated with repalcing/ upgrading toilets to 1.28 GPF fixtures and/or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Toilets in Building	5	
Average Flushes / Toilet (per Day)	16	Based on # of occupants
Average Gallons / Flush	3.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	5	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	102.20	kGal / year
Proposed Toilet Water Use	37.38	kGal / year
Water Savings	64.82	kGal / year
Cost Savings	$583	/ year

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Building 2

ECM-7: Replace faucets with low flow

Description; This ECM evaluates the water savings resulting from replacing/ upgrading faucets to 0.5 gallon per minute flow

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Faucets in Building	7	
Average Uses / Faucet (per day)	8	Based on # of occupants
Average Time of Use	10.0	seconds
Average Flowrate	2.5	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	7	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	$ 0.12	kWH
Number of Faucets	7	
Hours per Day of Usage	0.5	hrs
Days per Year of Facility Usage	182	days
Average Flowrate	2.5	gpm
Proposed Flowrate	0.5	gpm
Heat Content of Water	8.33	Btu/gal/F
Temperature Difference (Intake and Output)	50	F
Water Heating Equipment Efficiency	100%	
Conversion Factor	3,413	Btu/Therm
SAVINGS		
Current Faucet Water Use	4.25	kGal / year
Proposed Faucet Water Use	0.85	kGal / year
Water Savings	3.40	kGal / year
Heating Savings	933	kWH
Cost Savings	$143	/ year

Savings calculation formulas are taken from NJ Protocols document for Faucet

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District LGEA
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Building 2

Replace Plumbing Fixtures with Low-Flow Equivalents - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Low-Flow Urinal	2	EA	$ 1,200	$ 1,000	$ -	$ 2,465	$ 2,492	$ -	$ 4,957	Vendor Estimate
Low-Flow Toilet	5	EA	$ 1,400	$ 1,000	$ -	$ 7,189	$ 6,230	$ -	$ 13,419	Vendor Estimate
Low-Flow Faucet	7	EA	$ 20	$ 20	$ -	$ 144	$ 174	$ -	$ 318	Vendor Estimate
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 18,694	Subtotal
$ 4,674	25% Contingency
$ 23,368	**Total**

Morris County Vocational Technical School District LGEA
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Building 2

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be met:

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	9,225
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$13,470	$6,449
Existing Usage (from utility)	119,944	5,726
Proposed Savings	40,566	2,823
Existing Total MMBtus	982	
Proposed Savings MMBtus	421	
% Energy Reduction	**42.8%**	
Proposed Annual Savings	$9,255	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$4,462	$3,529	$7,991
Incentive #3	$4,462	$3,529	$7,991
Total All Incentives	**$8,924**	**$7,057**	**$20,982**

Total Project Cost	$456,226

		Allowable Incentive
% Incentives #1 of Utility Cost*	25.1%	$5,000
% Incentives #2 of Project Cost**	1.8%	$7,991
% Incentives #3 of Project Cost**	1.8%	$7,991
Total Eligible Incentives***	**$20,982**	
Project Cost w/ Incentives	$435,245	

Project Payback (years)	
w/o Incentives	w/ Incentives
49.3	47.0

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 2

CHA Project No. 28950

ECM-L1 Lighting Replacements

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
Field Code	Area Description Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of Fixtures No. of fixtures before the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Fixt No.)	Exist Control Pre-inst. control device	Annual Hours Estimated daily hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Number of Fixtures No. of fixtures after the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Number of Fixtures)	Retrofit Control Retrofit control device	Annual Hours Estimated annual hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Annual kWh Saved (Original Annual kWh) - (Retrofit Annual kWh)	Annual kW Saved (Original Annual kW) - (Retrofit Annual kW)	Annual $ Saved (kWh Saved) * ($/kWh)	Retrofit Cost Cost for renovations to lighting system	NJ Smart Start Lighting Incentive Prescriptive Lighting Measures	Simple Payback With Out Incentive Length of time for renovations cost to be recovered	Simple Payback Length of time for renovations cost to be recovered
182LED	Entrance Vestibule	2	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	Breaker	2280	301	2	STLED3	STLED3	26	0.1	Breaker	2,280	119	182	0.1	$ 19.82	$ 563.40	$100	28.4	23.4
182LED	Hallway	26	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.7	SW	2280	3,912	26	STLED3	STLED3	26	0.7	SW	2,280	1,541	2,371	1.0	$ 257.71	$ 7,324.20	$1,300	28.4	23.4
218LED	Janitor/Storage	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	SW	1,500	60	75	0.1	$ 8.88	$ 281.70	$50	31.7	26.1
192	208 Storage	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	1500	923	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	1,500	923	-	0.0	$ -	$ -	$0		#DIV/0!
41LED	208 Storage	2	W 40 C F 2 (MAG)	F42SS	94	0.2	SW	1500	282	2	STLED4	STLED4	40	0.1	SW	1,500	120	162	0.1	$ 19.18	$ 563.40	$100	29.4	24.2
40LED	Handicap Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1500	90	1	T 38 R LED	RTLED38	38	0.0	SW	1,500	57	33	0.0	$ 3.91	$ 303.75	$50	77.7	64.9
41LED	Boiler Room	1	W 40 C F 2 (MAG)	F42SS	94	0.1	SW	1500	141	1	STLED4	STLED4	40	0.0	SW	1,500	60	81	0.1	$ 9.59	$ 281.70	$50	29.4	24.2
35LED	207 Superintendant of Adult Education	8	T 32 R F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304	8	T 59 R LED	RTLED38	38	0.3	SW	3,200	973	1,331	0.4	$ 137.53	$ 2,430.00	$400	17.7	14.8
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
182LED	Room 205	18	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.2	SW	3200	3,802	18	STLED3	STLED3	26	0.5	SW	3,200	1,498	2,304	0.7	$ 238.03	$ 5,070.60	$900	21.3	17.5
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	602	4	2T 25 R LED	2RTLED	25	0.1	SW	3,200	320	282	0.1	$ 29.09	$ 810.00	$200	27.8	21.0
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	602	4	2T 25 R LED	2RTLED	25	0.1	SW	3,200	320	282	0.1	$ 29.09	$ 810.00	$200	27.8	21.0
182LED	204/205 Common Room	3	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.2	SW	3200	634	3	STLED3	STLED3	26	0.1	SW	3,200	250	384	0.1	$ 39.67	$ 845.10	$150	21.3	17.5
4LED	204/205 Common Room	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	461	2	2T 25 R LED	2RTLED	25	0.1	SW	3,200	160	301	0.1	$ 31.08	$ 405.00	$100	13.0	9.8
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108	1	2T 25 R LED	2RTLED	25	0.0	SW	1,500	38	71	0.0	$ 8.35	$ 202.50	$50	24.3	18.3
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108	1	2T 25 R LED	2RTLED	25	0.0	SW	1,500	38	71	0.0	$ 8.35	$ 202.50	$50	24.3	18.3
54LED	204/205 Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1500	108	1	STLED4	STLED4	40	0.0	SW	1,500	60	48	0.0	$ 5.68	$ 281.70	$50	49.6	40.8
182LED	Room 204	11	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.7	SW	3200	2,323	11	STLED3	STLED3	26	0.3	SW	3,200	915	1,408	0.4	$ 145.46	$ 3,098.70	$550	21.3	17.5
4LED	Room 204	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691	3	2T 25 R LED	2RTLED	25	0.1	SW	3,200	240	451	0.1	$ 46.61	$ 607.50	$150	13.0	9.8
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	SW	3,200	243	333	0.1	$ 34.38	$ 607.50	$100	17.7	14.8
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440	5	T 59 R LED	RTLED38	38	0.2	SW	3,200	608	832	0.3	$ 85.96	$ 1,518.75	$250	17.7	14.8
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440	5	T 59 R LED	RTLED38	38	0.2	SW	3,200	608	832	0.3	$ 85.96	$ 1,518.75	$250	17.7	14.8
182LED	Room 203	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,901	9	STLED3	STLED3	26	0.2	SW	3,200	749	1,152	0.4	$ 119.02	$ 2,535.30	$450	21.3	17.5
4LED	Room 203	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	461	2	2T 25 R LED	2RTLED	25	0.1	SW	3,200	160	301	0.1	$ 31.08	$ 405.00	$100	13.0	9.8
41LED	Room 203	3	W 40 C F 2 (MAG)	F42SS	94	0.3	SW	3200	902	3	STLED4	STLED4	40	0.1	SW	3,200	384	518	0.2	$ 53.56	$ 845.10	$150	15.8	13.0
182LED	Room 202	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,901	9	STLED3	STLED3	26	0.2	SW	3,200	749	1,152	0.4	$ 119.02	$ 2,535.30	$450	21.3	17.5
4LED	Room 202	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691	3	2T 25 R LED	2RTLED	25	0.1	SW	3,200	240	451	0.1	$ 46.61	$ 607.50	$150	13.0	9.8
182LED	Mens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99	1	STLED3	STLED3	26	0.0	SW	1,500	39	60	0.0	$ 7.10	$ 281.70	$50	39.7	32.6
218LED	Mens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	SW	1,500	60	75	0.1	$ 8.88	$ 281.70	$50	31.7	26.1
182LED	Womens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99	1	STLED3	STLED3	26	0.0	SW	1,500	39	60	0.0	$ 7.10	$ 281.70	$50	39.7	32.6
218LED	Womens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	SW	1,500	60	75	0.1	$ 8.88	$ 281.70	$50	31.7	26.1

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
ECM-L1 Lighting Replacements

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
	Total	**146**				**10.8**			**30,186**	**146**				**1,217**	**4.8**			**12,844**	**17,341**	**6.0**	**$1,818**	**$38,819**	**$57,050**		
																		Demand Savings			**6.0**	**$257**			
																		kWh Savings			**17,341**	**$1,561**			
																		Total savings				**$1,818**		**21.4**	**17.5**

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
182LED	Entrance Vestibule	2	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	Breaker	2280	301.0	2	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	NONE	2280	301.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
182LED	Hallway	26	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.7	SW	2280	3,912.5	26	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.7	NONE	2280	3,912.5	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	Janitor/Storage	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135.0	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	NONE	1500	135.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
192	208 Storage	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	1500	922.5	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	NONE	1500	922.5	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
41LED	208 Storage	2	W 40 C F 2 (MAG)	F42SS	94	0.2	SW	1500	282.0	2	W 40 C F 2 (MAG)	F42SS	94	0.2	NONE	1500	282.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
40LED	Handicap Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1500	90.0	1	T 32 R F 2 (ELE)	F42LL	60	0.1	C-OCC	1050	63.0	27.0	0.0	$2.43	$270.00	$35.00	111.1	96.7
41LED	Boiler Room	1	W 40 C F 2 (MAG)	F42SS	94	0.1	SW	1500	141.0	1	W 40 C F 2 (MAG)	F42SS	94	0.1	NONE	1500	141.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
35LED	207 Superintendant of Adult Education	8	T 32 R F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304.0	8	T 32 R F 3 (ELE)	F43ILL/2	90	0.7	C-OCC	2240	1,612.8	691.2	0.0	$62.21	$270.00	$35.00	4.3	3.8
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
182LED	Room 205	18	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.2	SW	3200	3,801.6	18	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.2	C-OCC	2240	2,661.1	1,140.5	0.0	$102.64	$270.00	$35.00	2.6	2.3
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	601.6	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	C-OCC	2240	421.1	180.5	0.0	$16.24	$270.00	$35.00	16.6	14.5
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	601.6	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	C-OCC	2240	421.1	180.5	0.0	$16.24	$270.00	$35.00	16.6	14.5
182LED	204/205 Common Room	3	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.2	SW	3200	633.6	3	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.2	C-OCC	2240	443.5	190.1	0.0	$17.11	$270.00	$35.00	15.8	13.7
4LED	204/205 Common Room	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	460.8	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	C-OCC	2240	322.6	138.2	0.0	$12.44	$270.00	$35.00	21.7	18.9
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108.0	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	NONE	1500	108.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108.0	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	NONE	1500	108.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	204/205 Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1500	108.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	1050	75.6	32.4	0.0	$2.92	$270.00	$35.00	92.6	80.6
182LED	Room 204	11	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.7	SW	3200	2,323.2	11	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.7	C-OCC	2240	1,626.2	697.0	0.0	$62.73	$270.00	$35.00	4.3	3.7
4LED	Room 204	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691.2	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	C-OCC	2240	483.8	207.4	0.0	$18.66	$270.00	$35.00	14.5	12.6
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	2240	403.2	172.8	0.0	$15.55	$270.00	$35.00	17.4	15.1
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440.0	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	2240	1,008.0	432.0	0.0	$38.88	$270.00	$35.00	6.9	6.0
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440.0	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	2240	1,008.0	432.0	0.0	$38.88	$270.00	$35.00	6.9	6.0
182LED	Room 203	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,900.8	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	C-OCC	2240	1,330.6	570.2	0.0	$51.32	$270.00	$35.00	5.3	4.6
4LED	Room 203	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	460.8	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	C-OCC	2240	322.6	138.2	0.0	$12.44	$270.00	$35.00	21.7	18.9
41LED	Room 203	3	W 40 C F 2 (MAG)	F42SS	94	0.3	SW	3200	902.4	3	W 40 C F 2 (MAG)	F42SS	94	0.3	C-OCC	2240	631.7	270.7	0.0	$24.36	$270.00	$35.00	11.1	9.6
182LED	Room 202	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,900.8	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	C-OCC	2240	1,330.6	570.2	0.0	$51.32	$270.00	$35.00	5.3	4.6
4LED	Room 202	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691.2	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	C-OCC	2240	483.8	207.4	0.0	$18.66	$270.00	$35.00	14.5	12.6
182LED	Mens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99.0	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	NONE	1500	99.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	Mens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135.0	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	NONE	1500	135.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
182LED	Womens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99.0	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	NONE	1500	99.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	Womens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135.0	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	NONE	1500	135.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!

Morris County Vocational Technical School LGEA - Building 2

CHA Project No. 28950

ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
182LED	Entrance Vestibule	2	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	Breaker	2280	301	2	STLED3	STLED3	26	0.1	NONE	2,280	119	182	0.1	$ 19.82	$ 563.40	$ 100	28.4	23.4
182LED	Hallway	26	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.7	SW	2280	3,912	26	STLED3	STLED3	26	0.7	NONE	2,280	1,541	2,371	1.0	$ 257.71	$ 7,324.20	$ 1,300	28.4	23.4
218LED	Janitor/Storage	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	NONE	1,500	60	75	0.1	$ 8.88	$ 281.70	$ 50	31.7	26.1
192	208 Storage	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	1500	923	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	NONE	1,500	923	-	0.0	$ -	$ -	$ -	-	-
41LED	208 Storage	2	W 40 C F 2 (MAG)	F42SS	94	0.2	SW	1500	282	2	STLED4	STLED4	40	0.1	NONE	1,500	120	162	0.1	$ 19.18	$ 563.40	$ 100	29.4	24.2
40LED	Handicap Restroom	1	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1500	90	1	T 38 R LED	RTLED38	38	0.0	C-OCC	1,050	40	50	0.0	$ 5.45	$ 573.75	$ 85	105.3	89.7
41LED	Boiler Room	1	W 40 C F 2 (MAG)	F42SS	94	0.1	SW	1500	141	1	STLED4	STLED4	40	0.0	NONE	1,500	60	81	0.1	$ 9.59	$ 281.70	$ 50	29.4	24.2
35LED	207 Superintendant of Adult Education	8	T 32 R F 3 (ELE)	F43ILL/2	90	0.7	SW	3200	2,304	8	T 59 R LED	RTLED38	38	0.3	C-OCC	2,240	681	1,623	0.4	$ 163.80	$ 2,700.00	$ 435	16.5	13.8
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
35LED	207 Superintendant of Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
182LED	Room 205	18	W 25 C F 2 (ELE) 3' T8	F32EE	66	1.2	SW	3200	3,802	18	STLED3	STLED3	26	0.5	C-OCC	2,240	1,048	2,753	0.7	$ 278.47	$ 5,340.60	$ 935	19.2	15.8
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
35LED	Adult Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	602	4	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	224	378	0.1	$ 37.73	$ 1,080.00	$ 235	28.6	22.4
55LED	206 Career Center	4	2T 17 R F 3 (ELE)	F23ILL	47	0.2	SW	3200	602	4	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	224	378	0.1	$ 37.73	$ 1,080.00	$ 235	28.6	22.4
182LED	204/205 Common Room	3	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.2	SW	3200	634	3	STLED3	STLED3	26	0.1	C-OCC	2,240	175	459	0.1	$ 46.41	$ 1,115.10	$ 185	24.0	20.0
4LED	204/205 Common Room	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	461	2	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	112	349	0.1	$ 35.40	$ 675.00	$ 135	19.1	15.3
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108	1	2T 25 R LED	2RTLED	25	0.0	NONE	1,500	38	71	0.0	$ 8.35	$ 202.50	$ 50	24.3	18.3
4LED	204/205 Storage	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	1500	108	1	2T 25 R LED	2RTLED	25	0.0	NONE	1,500	38	71	0.0	$ 8.35	$ 202.50	$ 50	24.3	18.3
54LED	204/205 Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1500	108	1	STLED4	STLED4	40	0.0	C-OCC	1,050	42	66	0.0	$ 7.30	$ 551.70	$ 85	75.5	63.9
182LED	Room 204	11	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.7	SW	3200	2,323	11	STLED3	STLED3	26	0.3	C-OCC	2,240	641	1,683	0.4	$ 170.17	$ 3,368.70	$ 585	19.8	16.4
4LED	Room 204	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691	3	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	168	523	0.1	$ 53.09	$ 877.50	$ 185	16.5	13.0
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
35LED	Continuing Education	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	3200	576	2	T 59 R LED	RTLED38	38	0.1	C-OCC	2,240	170	406	0.1	$ 40.95	$ 877.50	$ 135	21.4	18.1
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440	5	T 59 R LED	RTLED38	38	0.2	C-OCC	2,240	426	1,014	0.3	$ 102.37	$ 1,788.75	$ 285	17.5	14.7
35LED	Continuing Education	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	3200	1,440	5	T 59 R LED	RTLED38	38	0.2	C-OCC	2,240	426	1,014	0.3	$ 102.37	$ 1,788.75	$ 285	17.5	14.7
182LED	Room 203	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,901	9	STLED3	STLED3	26	0.2	C-OCC	2,240	524	1,377	0.4	$ 139.23	$ 2,805.30	$ 485	20.1	16.7
4LED	Room 203	2	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	461	2	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	112	349	0.1	$ 35.40	$ 675.00	$ 135	19.1	15.3
41LED	Room 203	3	W 40 C F 2 (MAG)	F42SS	94	0.3	SW	3200	902	3	STLED4	STLED4	40	0.1	C-OCC	2,240	269	634	0.2	$ 63.93	$ 1,115.10	$ 185	17.4	14.5
182LED	Room 202	9	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.6	SW	3200	1,901	9	STLED3	STLED3	26	0.2	C-OCC	2,240	524	1,377	0.4	$ 139.23	$ 2,805.30	$ 485	20.1	16.7
4LED	Room 202	3	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.2	SW	3200	691	3	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,240	168	523	0.1	$ 53.09	$ 877.50	$ 185	16.5	13.0
182LED	Mens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99	1	STLED3	STLED3	26	0.0	NONE	1,500	39	60	0.0	$ 7.10	$ 281.70	$ 50	39.7	32.6
218LED	Mens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	NONE	1,500	60	75	0.1	$ 8.88	$ 281.70	$ 50	31.7	26.1
182LED	Womens Restroom	1	W 25 C F 2 (ELE) 3' T8	F32EE	66	0.1	SW	1500	99	1	STLED3	STLED3	26	0.0	NONE	1,500	39	60	0.0	$ 7.10	$ 281.70	$ 50	39.7	32.6
218LED	Womens Restroom	1	W 32 P F 3 (ELE)	F43ILL/2	90	0.1	SW	1500	135	1	STLED4	STLED4	40	0.0	NONE	1,500	60	75	0.1	$ 8.88	$ 281.70	$ 50	31.7	26.1
															0	#N/A								#VALUE!

Morris County Vocational Technical School LGEA - Building 2
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
															0	#N/A								#VALUE!

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

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COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

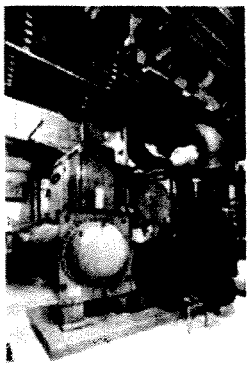
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

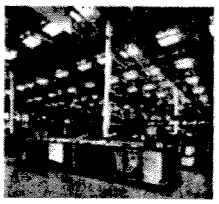
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

Home | Residential | Commercial & Industrial | Renewable Energy
About Us | Press Room | Library | FAQs | Calendar | Newsletters | Contact Us | Site

New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX E

Photovoltaic Analysis

APPENDIX F

Photos



1: Building 2 Main Hall Lighting



2: HB Smith Boiler



3: Electric Water Heater



4: Typical Office Space with Portable AC

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

63

ENERGY STAR® Score[1]

Building 2

Primary Property Function: K-12 School
Gross Floor Area (ft²): 9,225
Built: 1956

For Year Ending: May 31, 2014
Date Generated: October 27, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Building 2 400 East Main Street Denville, New Jersey 07834	Morris County Vocational School District 400 E Main Street Denville, NJ 07834 (____)____-_____	Mike Orlovsky 400 E Main Street Denville, NJ 07834 (518)453-3980 mdewein@chacompanies.com

Property ID: 4195867

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
39 kBtu/ft²

Source EUI
122.5 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	359,976 (100%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	44.2
National Median Source EUI (kBtu/ft²)	138.8
% Diff from National Median Source EUI	-12%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	48

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 3
400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 3 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 3	400 E Main St, Denville, NJ 07834	24,800	1974

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
136,489	6,245	24,715	18.3

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

Summary of Energy Conservation Measures

ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Replace Windows	162,242	1,553	104.4	0	104.4	Y
2	Replace Door Seals	2,535	560	4.5	0	4.5	Y
3	Install Condensing Boiler for Shoulder Months	65,718	5,381	12.2	2,625	11.7	Y
4	Install Heating Hot Water Pump VFDs & Premium Motors	8,061	1,110	7.3	1,658	5.8	Y
5	Replace Trane H&V Units	57,008	1,250	45.6	0	45.6	Y
6	Condensing DHW Boiler & New Storage Tanks	10,716	173	62.1	0	61.8	Y
7	Computer Network Controller	1,776	41	43.0	0	43.0	Y
8	Install Low Flow Plumbing Fixtures	39,057	1,176	33.2	0	33.2	Y
L1	Lighting Replacements / Upgrades**	119,061	13,349	8.9	11,932	8.0	N
L2	Install Lighting Controls (Add Occupancy Sensors)**	3,510	297	11.8	209	11.1	N
L3	Lighting Replacements with Controls (Occupancy Sensors)	122,571	13,470	9.1	12,042	8.2	Y
	Total**	469,684	24,715	19	16,375	18	
	Total (Recommended)	469,684	24,715	19	16,375	18	

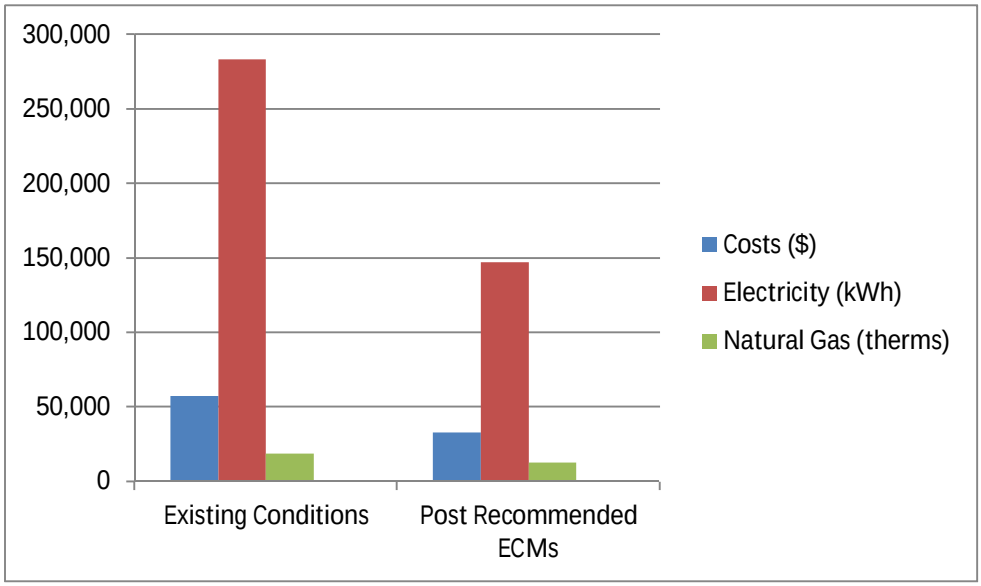
* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

The following alternative energy measures are also recommended for further study:

- Photovoltaic (PV) Rooftop Solar Power Generation – 170 kW System

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	57,696	32,837	43%
Electricity (kWh)	283,629	147,140	48%
Natural Gas (therms)	18,933	12,688	33%
Site EUI (kbtu/SF/Yr)	115.4	71.4	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 3
Gross Floor Area: 24,800
Number of Floors: 1
Year Built: 1974
Additions: None



Description of Spaces: Shop style classrooms, offices, storage rooms, toilet rooms and a mechanical room.
Description of Occupancy: This building houses classroom spaces for secondary or high school level and post-secondary/adult vocational and technical education.
Number of Computers: The school has approximately 5 desktop computers.
Building Usage: The secondary school hours of operation are 8:15 AM – 3:00 PM Monday through Friday, with various post-secondary activities until 6:00 PM. Custodians are in the building until 11:00 each night. In general the occupied hours are considered 80 hours per week, 10 months per year

Building Envelope

Construction Materials: Steel framed concrete masonry unit (CMU) exterior walls
Façade: Brick exterior fascia
Roof: Pitched metal roof decking with minimal insulation, white rubber membrane. The roof is in good condition, and no ECMs were required.
Windows: Single pane aluminum frame windows. These windows are in poor condition and an ECM is included to address replacement of these windows.
Exterior Doors: Single pane full window doors with aluminum frames. The door sweeps and seals on exterior doors are in poor condition and an ECM for door seal replacements has been included.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating & Cooling: Heating hot water serving this building is produced by (2) Smith cast iron sectional boilers. These boilers produce 180°F water that is distributed to terminal devices such as cabinet heaters and H&V units at an estimated 80% system efficiency. This HHW is circulated to these terminal devices by (2) nominal efficiency 5 HP heating hot water pumps.

An ECM to install a supplemental condensing boiler to heat more efficiently in the shoulder months, and a second ECM to replace the heating hot water pump motors with premium efficiency motors and variable frequency drives (VFDs).

Heating and ventilation for the classrooms and offices is provided by original Trane heating & ventilating (H&V) units located in the mezzanine of each classroom space. Each H&V unit has a heating hot water coil fed by the main boiler plant. These units are in poor condition and have reached the end of their useful life.

The veterinary science classroom (302A) has one Suntherm air handling unit mounted to the ceiling paired to a DX air cooled condensing unit. This unit serves the vet sciences classroom and provides cooling only. A large McQuay H&V unit also provides heat to the vet sciences classroom. This unit has a heating hot water coil supplied by the main boilers.

An ECM has been included to replace the original H&V units.

Exhaust: Exhaust for toilet rooms is provided by fractional HP roof mounted exhaust fans. The exhaust fans are manually controlled. All exhaust fans are in good condition.

Controls Systems

This building is being upgraded with a new campus-wide BAS control system. The spaces are currently heated to 72°F occupied and 60°F unoccupied, and cooled to 76°F occupied and 85°F unoccupied. It is assumed that this new controls system will serve the needs of the facility and will operate effectively once installation is completed; therefore no ECMs are being considered for controls.

Domestic Hot Water Systems

Domestic hot water (DHW) is provided by one 80% efficient 80 gallon natural gas fired tank type water heater. This water heater is in poor condition and has exceeded its useful life. This water heater maintains 140°F water temperature at an estimated 80% system efficiency. DHW is recirculated to toilet rooms by a fractional horsepower circulation pump.

In addition to the main water heater, there is a smaller 50 gallon natural gas fired tank type water heater located in the 302A mezzanine that creates DHW for the dishwasher. This water heater is new and in good condition, and was noted to only operate when needed. The piping between the water heater and the dishwasher is uninsulated, which allows heat to radiate out of the copper pipe.

An ECM has been included to replace the main DHW heater serving the majority of the building with a high efficiency condensing water heater.

Kitchen Equipment

There is no kitchen in this building.

Plug Load

This school has computers with LCD monitors, copiers, residential appliances (microwave, refrigerator), printers, and portable electric heaters (personal) which contribute to the plug load in the building. The installation of computer network controller software has been included as an ECM in an attempt to reduce the standby plug loads of the computers.

Plumbing Systems

The plumbing fixtures in this building are all older and appear original to the building construction. The water closets consume an estimated 3.0 gallons per flush (GPF) each, the urinals consume an estimated 2.0 gallons per flush and the faucets flow 2.0 gallons per minute.

An ECM is included to evaluate the water savings potential of installing low-flow water closets urinals and faucet aerators.

Lighting Systems

Lighting within this building consists of primarily T12 linear and u-tube fluorescent fixtures in the hallways, offices, and restrooms. The shop classrooms utilize 400 watt high bay mercury vapor HID fixtures. All of the lighting in this building is controlled manually by wall mounted switches. Although the existing lighting fixtures provide sufficient light for the spaces served, they are very inefficient and can be improved upon with more modern technology and automatic controls.

Three lighting ECMs have been included which include adding occupancy sensors to the existing lighting, replacement of the T-12 and HID lighting with LED lighting and a third ECM that evaluates the effect of occupancy sensors used with the LED lighting upgrades.

3.0 UTILITIES

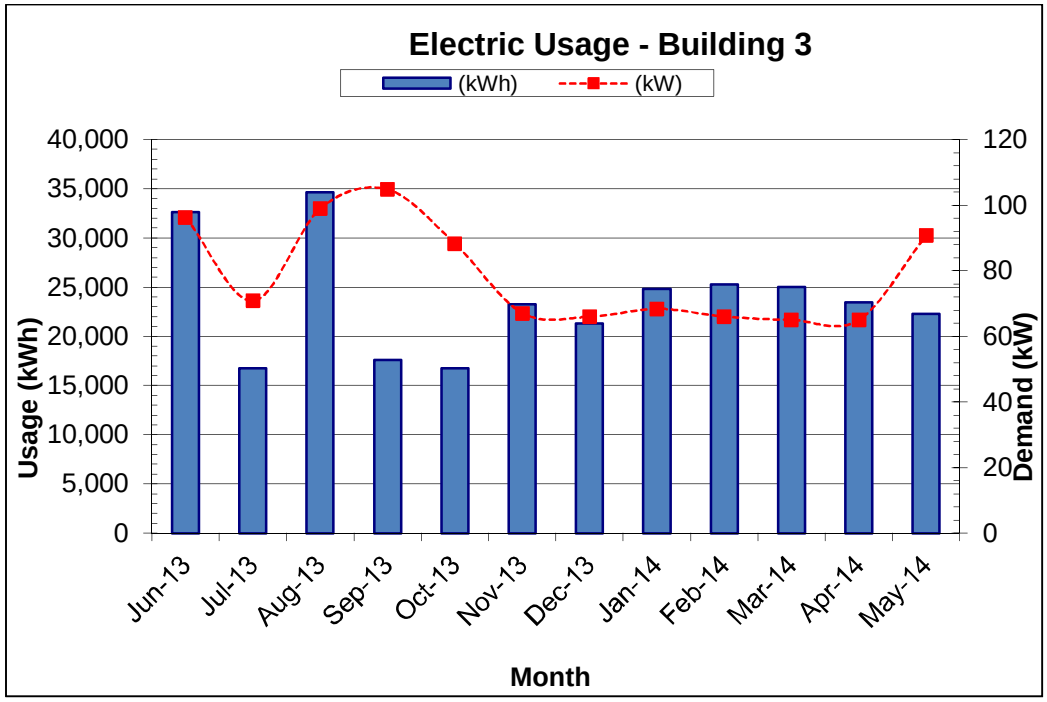
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	First Energy Solutions Corp.	New Jersey Natural Gas

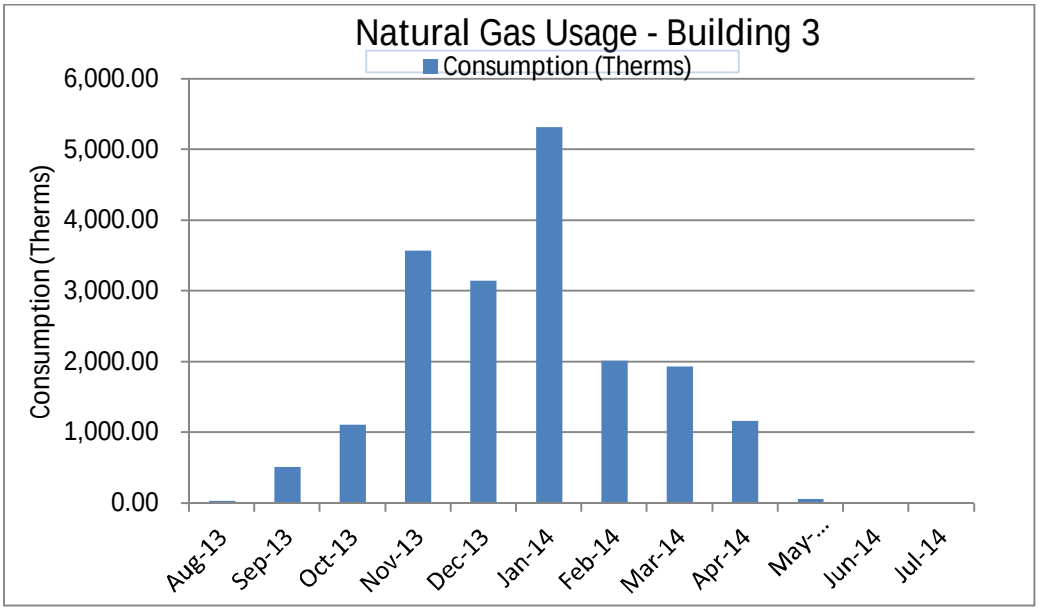
For the 12-month period ending in May 2014, the utilities usages and costs for the building were as follows:

Electric		
Annual Consumption	283,629	kWh
Annual Cost	33,455	$
Blended Unit Rate	0.118	$/kWh
Supply Rate	0.091	$/kWh
Demand Rate	6.43	$/kW
Peak Demand	104.9	kW
Natural Gas		
Annual Consumption	18,933	Therms
Annual Cost	24,241	$
Unit Rate	1.280	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



The electric usage presented in the graph above shows consumption that is typical of an air conditioned school, with peak electrical consumption and demand associated with summer months when cooling is in operation. Usage appears to be low in the months of July and August, 2013 which may be the result of the school being mostly shut down during that month.



The natural gas consumption presented in the graph above is typical of a school building with peak consumption occurring during the winter months when the heating load is at it's highest. From the graph, it is easy to tell that the consumption during the summer is predominantly used for domestic water heating as the building is not being heated.

In addition, domestic water and sewer services are provided by City of Newark Division of Water at $7.55/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.12	$0.13	Y
Natural Gas	$/Therm	$1.28	$0.96	Y
Fuel Oil	$/Gal		$3.62	

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

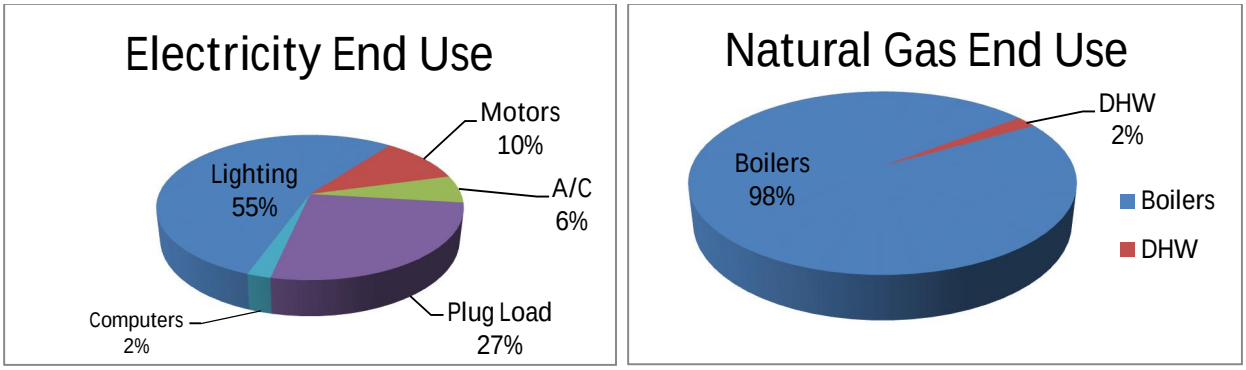
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

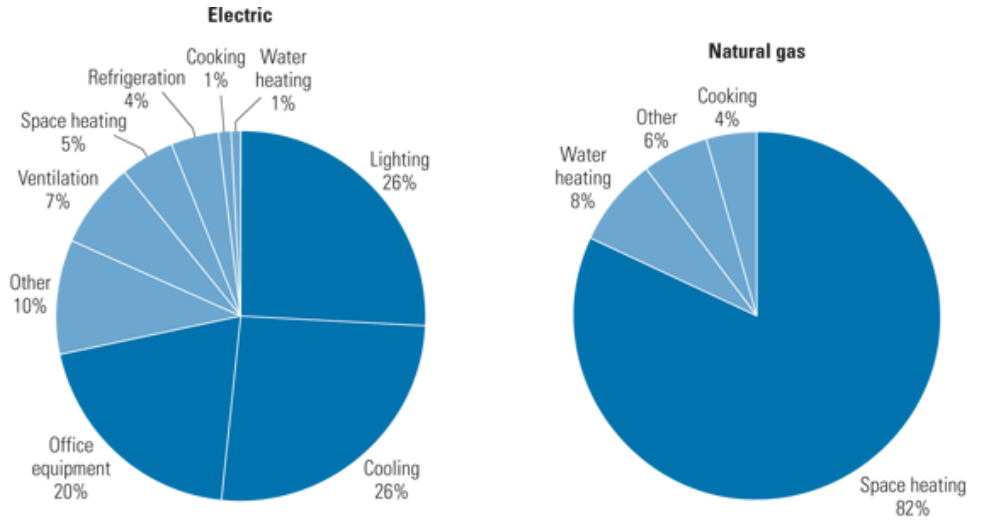
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
115.4	202.7	5

The school has a below average Energy Star Rating Score (50 being the median score), and as such by implementing the measures discussed in this report, it is expected that the EUI can be further reduced and the Energy Star Rating further increased. EPA Portfolio Manager data can be found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Replace Windows

The existing windows are older and utilize single pane glazing and aluminum frames. There are interior and exterior storm windows installed in some locations that add some additional insulation value, but do not help to improve the sealing of the existing windows. It is proposed to replace all of the windows at this building with new aluminum framed windows with double pane glazing and low-e coating. These new windows will reduce overall heat gain/loss and infiltration which will reduce the overall loads on the heating and cooling systems. Energy savings in the form of electricity and natural gas will result from these reduced heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Replace Windows

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
162,242	0	0	1,214	0	1,553	(0.8)	0	104.4	104.4

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.2 ECM-2 Replace Door Seals

The exterior doors have deteriorating sweeps and seals which allow for excessive building infiltration/exfiltration and increased heating and cooling loads. It is proposed to install new door sweeps and seals on all of the exterior doors to reduce this infiltration/exfiltration. Energy savings in the form of electricity and natural gas will result from this reduction of heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Replace Door Seals

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
2,535	0	0	437	0	560	2.3	0	4.5	4.5

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.3 ECM-3 Install Condensing Boiler for Shoulder Months

The existing boiler plant consists of two 80% efficient boilers which are in good condition. It is proposed to supplement this boiler plant with a high efficiency condensing boiler that will operate in shoulder months. Condensing boilers can operate at efficiencies of over 96% when in condensing mode. It is assumed that the proposed boiler will maintain a seasonal efficiency of 90% within the calculations. Natural gas savings will result from a higher overall system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-3 Replace Boiler with Condensing Boiler

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
65,718	0	0	4,204	0	5,381	1.0	2,625	12.2	11.7

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.4 ECM-4 Install HHW Pump VFDs & Premium Motors

The existing 5 HP heating hot water (HHW) pump motors are standard efficiency (87.5%) and currently can only provide constant water flow to the system all year. It is proposed to replace this motor with premium efficiency (90.5%) motors and install variable frequency drives (VFD) to allow for the pumps to modulate water flow based on actual heating load requirements. Electrical energy savings will result from a higher efficiency motors as well as reduced motor power draw during lower flow times.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-4 Install HHW Pump VFDs & Premium Motors

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
8,061	5.2	9,410	0	0	1,110	1.8	1,658	7.3	5.8

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.5 ECM-5 Replace Trane H&V units

The existing heating and ventilating (H&V) units serving the classroom spaces are original to the building and have reached the end of their useful life. Although the only energy consumed by these units is electrical energy used by the supply fan motors, it is proposed to replace these units with new equivalent sized H&V units having premium

efficiency motors. Energy savings in the form of electricity will result from newer high efficiency motors.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-5 Replace Trane H&V Units

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
57,008	0	10,597	0	0	1,250	(0.5)	0	45.6	45.6

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the effected equipment has reached the end of its useful life, and was requested by the school district.

5.6 ECM-6 Condensing Domestic Hot Water Heater

The existing domestic hot water heater is an 80 gallon standard efficiency natural gas fired tank type water heater. This water heater is nearing the end of its useful life and is in poor condition. It is proposed to replace this standard efficiency water heater with a natural gas-fired condensing water heater of the same storage capacity. Condensing water heaters operate at efficiencies above 96% year-round due to the low supply water temperature to the heaters. Cost savings will result from the improved overall system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-6 Condensing Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
10,716	0	0	135	0	173	(0.6)	50	62.1	61.8

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the existing water heater has reached the end of its useful life.

5.7 ECM-7 Computer Network Controller

There are approximately 5 desktop computers used in classrooms and offices in the building. These computers are generally left on when the spaces are unoccupied. Although there are sleep and/or hibernate functions built into the computers, there is more advanced computer network control software which will allow for the units to reduce standby electrical energy consumption even further when the computers are not

in use. Electrical energy savings will result from lower standby power draw of the computers during unoccupied hours.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-7 Computer Network Controller

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
1,776	0	350	0	0	41	(0.7)	0	43.0	43.0

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it will be included as a software package that will cover the entire campus.

5.8 ECM-8 Install Low Flow Plumbing Fixtures

The plumbing fixtures in this building are older high flow fixtures. The water savings associated from replacing existing high flow fixtures with low-flow fixtures was calculated by taking the difference of the annual water usage for the proposed and base case. The basis of this calculation is the estimate usage of each fixture, gallons per use, and number of fixtures. Replacing the existing fixtures in the restrooms with 1.28 Gals/flush toilets, 1.0 gal/flush urinals, and 0.5 gpm aerators will conserve water which will result in lower annual water and sewer charges.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-8 Install Low Flow Plumbing Fixtures

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
39,057	0	0	256	94	1,176	(0.1)	0	33.2	33.2

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.9.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of mostly T12 linear fluorescent fixtures which are outdated and an inefficient type of lighting. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
119,061	37.6	114,806	0	13,349	1.1	11,932	8.9	8.0

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is not recommended in lieu of ECM L3.

5.9.2 ECM-L2 Install Lighting Controls (Occupancy Sensors)

Presently, all interior lighting fixtures are controlled my wall mounted switches. Review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied.

This measure recommends installing occupancy sensors for the current lighting system. Using a process similar to that utilized in Section 5.7.1, the energy savings for this measure was calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L2 Install Lighting Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,510	0	2,513	0	297	0.3	209	11.8	11.1

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is not recommended in lieu of ECM L3.

5.9.3 ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

This measure is a combination of ECM-L1 and ECM-L2; recommending replace/upgrade the current lighting fixtures to more efficient ones and installing occupancy sensors on the new lights. Interactive effects of the higher efficiency lights and occupancy sensors lead the energy and cost savings for this measure to not be cumulative or equivalent to the sum of replacing the lighting fixtures alone and installing occupancy sensors without the lighting upgrade. The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
122,571	37.6	116,132	0	13,470	1.0	12,042	9.1	8.2

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is recommended.

5.10 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Replace H&V and AHU filters at least twice a year
- Insulate hot water piping between water heater and dishwasher
- Look for the ENERGY STAR® label when purchasing Kitchen Appliances
- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train custodians to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate students and staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.
- During the winter, Custodians should ensure all windows are closed as part of cleaning routine

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.05/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding

bonds or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The amount of available roof area determines how large of a solar array can be installed on any given roof. The table below summarizes the approximate roof area available on the building and the associated solar array size that can be installed.

Available Roof Area (Ft^2)	Potential PV Array Size (kW)
14,795	170

The PVWATTS solar power generation model was utilized to calculate PV power generation; this model is provided in Appendix E.

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey Solar Renewable Energy Certificates Program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. Payments that will be received by the PV producer (school) will change from year to year dependent upon supply and demand. There is no definitive way to calculate an exact price that will be received by the PV producer for SREC credits over the next 15 years. Renewable Energy Consultants estimates an average of $155/SREC for 2014 and this number was utilized in the cash flow for this report.

The system costs for PV installations were derived from recent solar contractor budgetary pricing in the state of New Jersey and include the total cost of the system installation (PV panels, inverters, wiring, ballast, controls). The cost of installation is currently about $4.00 per watt or $4,000 per kW of installed system, for a typical system. There are other considerations that have not been included in this pricing, such as the condition of the roof and need for structural reinforcement. Photovoltaic systems can be ground mounted if the roof is not suitable, however, this installation requires a substantial amount of open property (not wooded) and underground wiring, which adds more cost. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will most likely need to be replaced during the useful life of the PV system.

The implementation cost and savings related to this ECM are presented in Appendix E and summarized as follows:

Photovoltaic (PV) Rooftop Solar Power Generation – 170 kW System

Budgetary Cost	Annual Utility Savings			Total Savings	New Jersey Renewable SREC	Payback (without SREC)	Payback (with SREC)	Recommended
	Electricity		Natural Gas					
$	kW	kWh	Therms	$	$	Years	Years	Y/N
680,000	170	210,268	0	25,232	37,217	26.9	10.9	FS

Note: CHA typically recommends a more detailed evaluation be conducted for the installation of PV Solar arrays when the screening evaluation shows a payback of less than 20 years. Therefore, this ECM is recommended for further study. Before implementation is pursued, the school district should consult with a certified solar PV contractor.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

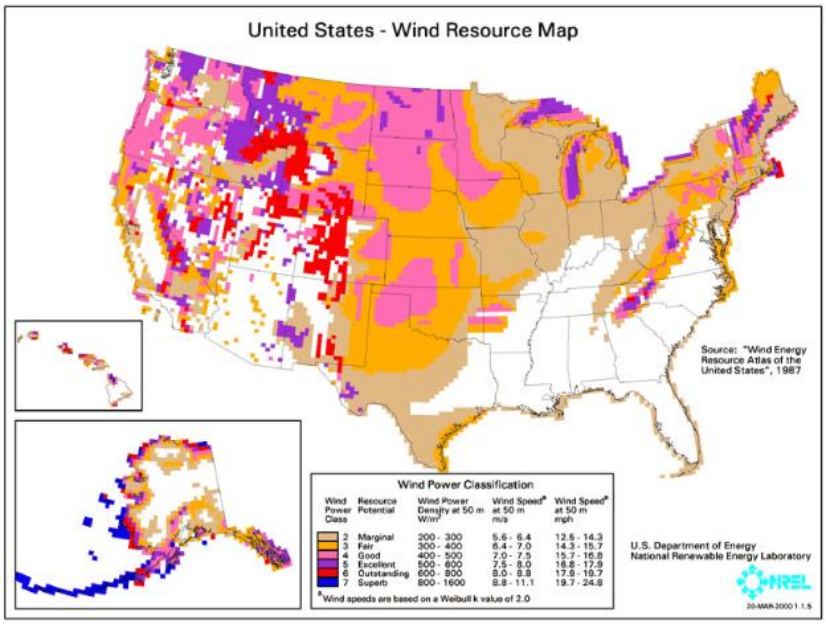
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind

turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal

usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

This school district already participates in a demand response program.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building Name.

The following projects should be considered for implementation:

- Replace Windows
- Replace Door Seals
- Install Condensing Boiler for Shoulder Months
- Install Heating Hot Water Pump VFDs & Premium Motors
- Replace Trane H&V Units
- Condensing DHW Heater
- Computer Network Controller
- Install Low Flow Plumbing Fixtures
- Lighting Replacements with Controls

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

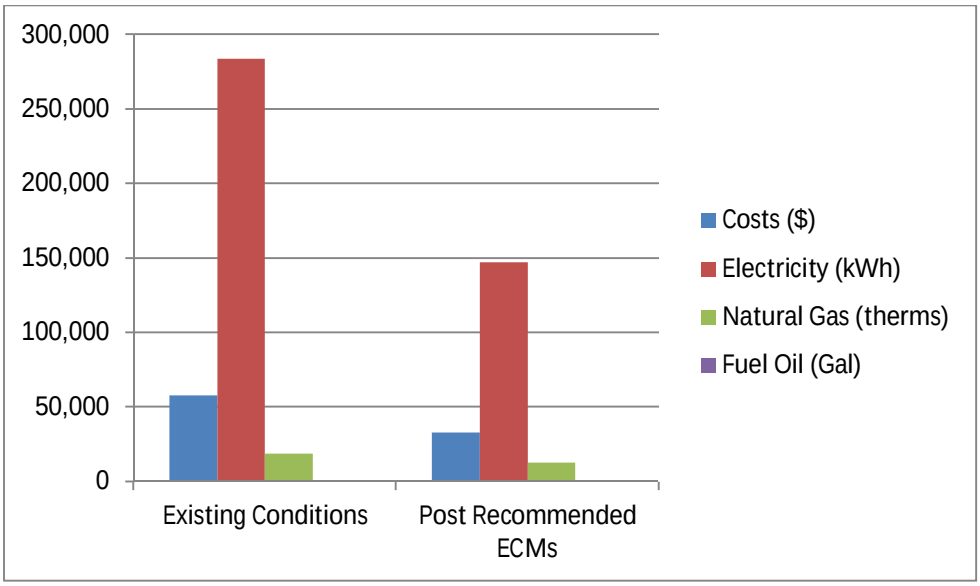
Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
136,489	6,245	24,715	18.3

The following alternative energy measures are recommended for further study:

- Photovoltaic (PV) Rooftop Solar Power Generation – 170 kW System

If the Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	57,696	32,837	43%
Electricity (kWh)	283,629	147,140	48%
Natural Gas (therms)	18,933	12,688	33%
Site EUI (kbtu/SF/Yr)	115.4	71.4	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 3
400 East Main Street, Denville, NJ 07834

Annual Utilities
12-month Summary

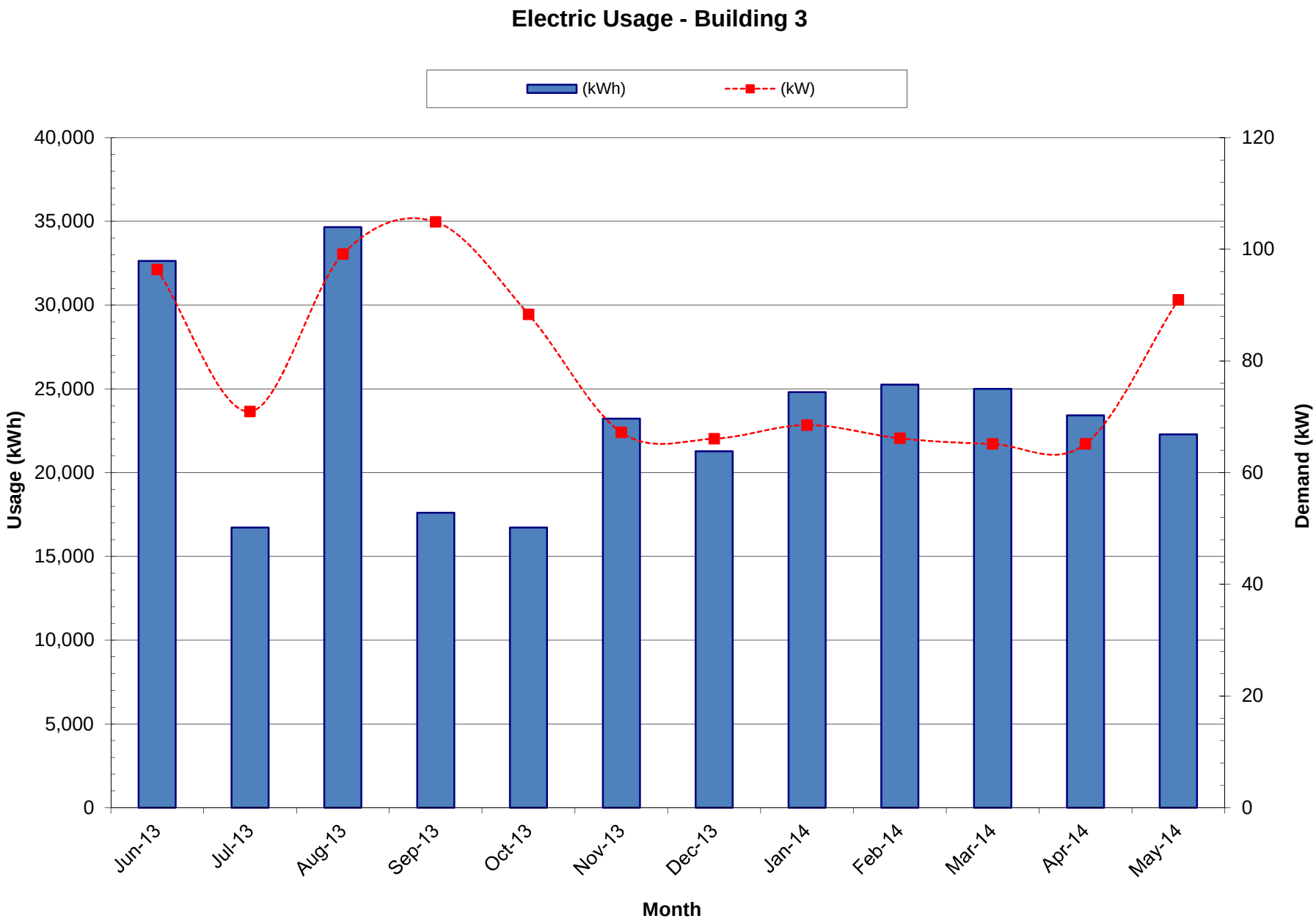
Electric		
Annual Usage	283,629	kWh/yr
Annual Cost	33,455	$
Blended Rate	0.118	$/kWh
Consumption Rate	0.091	$/kWh
Demand Rate	6.43	$/kW
Peak Demand	104.9	kW
Min. Demand	65.1	kW
Avg. Demand	77.5	kW
Natural Gas		
Annual Usage	18,933	Therms/yr
Annual Cost	24,241	$
Rate	1.280	$/therm
Water		
Annual Usage	820	kgal/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 3
400 East Main Street, Denville, NJ 07834

For Service at:
Account No.: **100000077717** **Delivery -** JCP & L
Meter No.: **L86699237** **Supplier -** First Energy Solutions Corp.
Electric Service

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	**Consump. (kWh)**	**Demand (kW)**	**Delivery ($)**	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Blended Rate ($/kWh)**	**Consumption ($/kWh)**	**Demand ($/kW)**
June-13	32,637	96.4	1,223.17	2,607.67	3,830.83	3,161.91	668.92	0.12	0.10	6.94
July-13	16,729	71.0	770.24	1,336.62	2,106.86	0.00	478.76	0.13	0.00	6.75
August-13	34,657	99.1	1,275.73	2,769.07	4,044.79	3,356.70	688.09	0.12	0.10	6.94
September-13	17,612	104.9	985.00	1,407.23	2,392.24	1,713.47	678.76	0.14	0.10	6.47
October-13	16,729	88.4	668.73	1,336.62	2,005.34	1,624.23	381.12	0.12	0.10	4.31
November-13	23,231	67.2	835.24	1,856.13	2,691.37	2,256.52	434.85	0.12	0.10	6.47
December-13	21,274	66.1	787.09	1,699.78	2,486.87	2,059.29	427.58	0.12	0.10	6.47
January-14	24,809	68.5	833.65	1,982.23	2,815.88	2,372.48	443.40	0.11	0.10	6.47
February-14	25,251	66.1	824.90	2,017.54	2,842.44	2,414.48	427.96	0.11	0.10	6.47
March-14	24,998	65.1	814.55	1,997.36	2,811.91	2,390.46	421.45	0.11	0.10	6.47
April-14	23,420	65.1	790.63	1,871.27	2,661.90	2,240.45	421.45	0.11	0.10	6.47
May-14	22,284	90.9	984.00	1,780.47	2,764.48	2,133.34	631.14	0.12	0.10	6.94
Total (All)	**250,993**	**104.91**	**$9,569.77**	**$20,054.30**	**$29,624.07**	**$22,561.42**	**$5,434.56**	**$0.12**	**$0.09**	**$6.37**
Total (last 12-months)	**283,629**	**104.91**	**$10,792.94**	**$22,661.97**	**$33,454.91**	**$25,723.33**	**$6,103.48**	**$0.118**	**$0.091**	**$6.432**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)

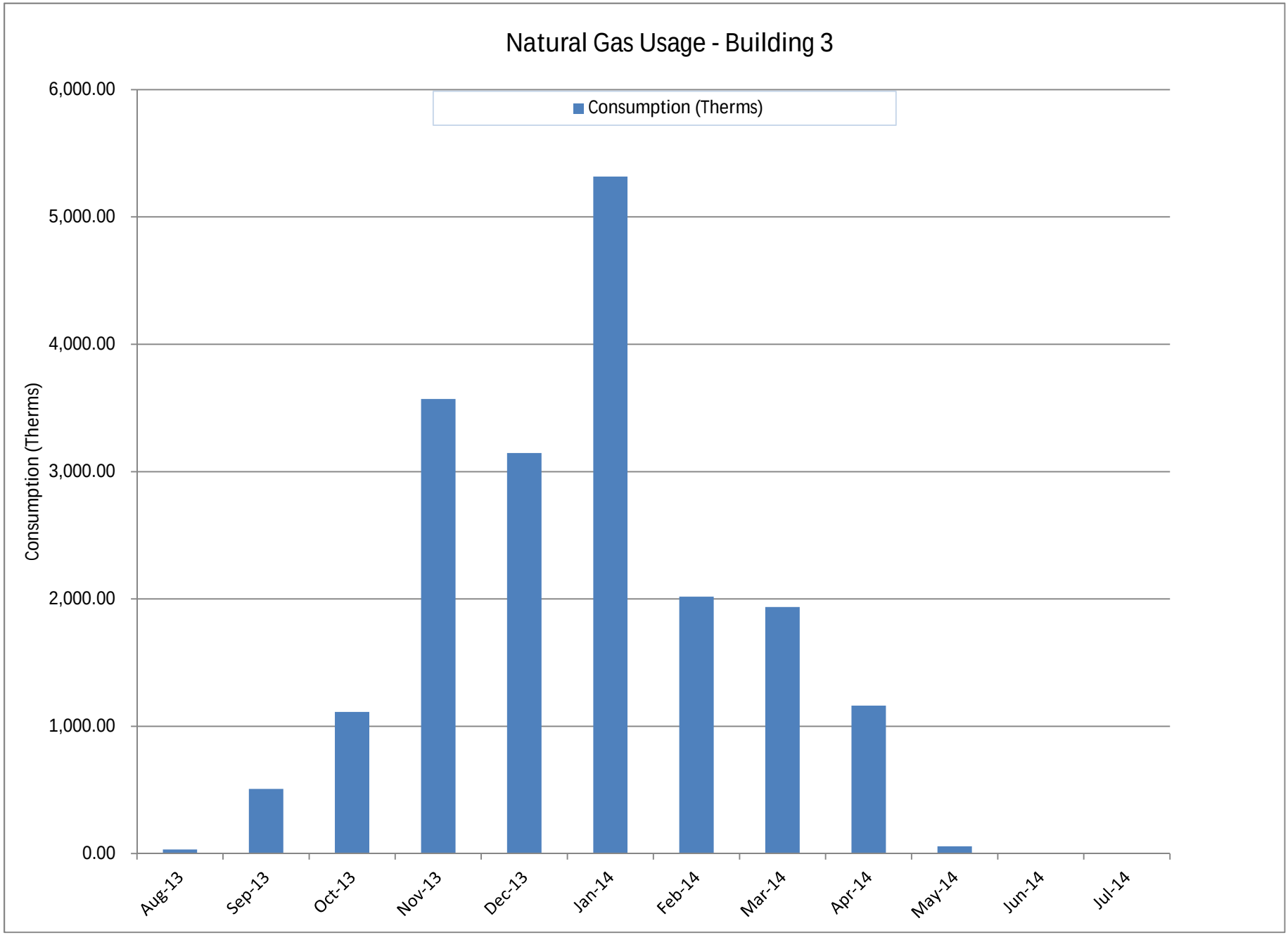


Utility Data -Building 3 Gas.xlsx
Electric Graph

Building 3
400 East Main Street, Denville, NJ 07834

For Service at: 400 East Main Street, Denville, NJ 07834
Account No.: 181287920019
Meter No: 851912
Natural Gas Service **Delivery -** New Jersey Natural Gas
Supplier - New Jersey Natural Gas

		Charges		Unit Costs	
Month	Consumption (Therms)	Delivery ($)	Total ($)	Delivery ($/Therm)	Total ($/Therm)
June-12	25.86	$ 330.49	$ 330.49	$ 12.780	$ 12.780
July-12	51.87	$ 815.25	$ 815.25	$ 15.717	$ 15.717
August-12	28.14	$ 479.44	$ 479.44	$ 17.038	$ 17.038
September-12	47.89	$ 494.18	$ 494.18	$ 10.319	$ 10.319
October-12	1,101.73	$ 1,409.78	$ 1,409.78	$ 1.280	$ 1.280
November-12	2,729.70	$ 2,945.71	$ 2,945.71	$ 1.079	$ 1.079
December-12	3,417.09	$ 3,633.49	$ 3,633.49	$ 1.063	$ 1.063
January-13	4,667.78	$ 4,739.50	$ 4,739.50	$ 1.015	$ 1.015
February-13	2,639.00	$ 2,856.18	$ 2,856.18	$ 1.082	$ 1.082
March-13	3,356.48	$ 3,518.29	$ 3,518.29	$ 1.048	$ 1.048
April-13	2,314.77	$ 2,671.37	$ 2,671.37	$ 1.154	$ 1.154
May-13	522.24	$ 973.91	$ 973.91	$ 1.865	$ 1.865
June-13	40.87	$ 496.42	$ 496.42	$ 12.146	$ 12.146
July-13	30.93	$ 485.98	$ 485.98	$ 15.712	$ 15.712
August-13	33.08	$ 487.25	$ 487.25	$ 14.729	$ 14.729
September-13	508.48	$ 941.82	$ 941.82	$ 1.852	$ 1.852
October-13	1,113.44	$ 1,414.83	$ 1,414.83	$ 1.271	$ 1.271
November-13	3,569.95	$ 3,884.91	$ 3,884.91	$ 1.088	$ 1.088
December-13	3,146.22	$ 3,437.11	$ 3,437.11	$ 1.092	$ 1.092
January-14	5,316.83	$ 5,573.94	$ 5,573.94	$ 1.048	$ 1.048
February-14	2,017.31	$ 2,500.50	$ 2,500.50	$ 1.240	$ 1.240
March-14	1,936.16	$ 2,611.60	$ 2,611.60	$ 1.349	$ 1.349
April-14	1,161.88	$ 1,887.70	$ 1,887.70	$ 1.625	$ 1.625
May-14	57.63	$ 518.69	$ 518.69	$ 9.000	$ 9.000
Total (12 Months)	**18,933**		**$ 24,240.75**		**$ 1.280**


Natural Gas Usage - Building 3
Consumption (Therms)
6,000.00
5,000.00
4,000.00
3,000.00
2,000.00
1,000.00
0.00
Consumption (Therms)
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

Back to main supplier information page

APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	Current year	Years Old	NJ Protocols life expectancy
HHW Boiler	3	2	Smith	Series 28A-10	N97-541	HHW Boiler/ Natural Gas	3,172 MBH	80%	Boiler Room	Building 3 Heating	1997	8		2014	17	25
HHW Pump	3	2	Bell & Gossett	Not Accessible	Not Accessible	HHW Pump/ Electric	5 HP	88%	Boiler Room	Building 3 Heating	1997	-2		2014	17	15
CUH	3	6	Unknown	Not Accessible	Not Accessible	Cabinet Unit Heater	Unknown	Unknown	Hallways	Building 3 Heating	1997	-2		2014	17	15
AHU	3	1	SunTherm	H15-53-80-AA1BACP1X	BF259652	AHU w/ DX Cooling/ Electric	5 Tons	12 EER	Room 302A	Room 302A	2001	2		2014	13	15
ACCU	3	1	York	H2DH060S06B	EFHM627808	ACCU/ Electric	5 Tons	12 EER	Outside Pad Mounted	AHU/Room 302A	2001	2		2014	13	15
AHU	3	1	McQuay	CAH030GHAC	FBOU120901105	H&V Unit/ HHW Coil	15,000 CFM, 5 HP SF	NA	Room 302A Mezzanine	Room 302A	2001	2		2014	13	15
H&V Unit	3	1	Trane	Torrivent	Not Accessible	H&V Unit/ HHW Coil	3/4 HP SF	NA	Room 302	Room 302	1974	-25		2014	40	15
H&V Unit	3	1	Trane	Torrivent	K4M280947	H&V Unit/ HHW Coil	3/4 HP SF	NA	Room 303	Room 303	1974	-25		2014	40	15
H&V Unit	3	1	Trane	Torrivent	K4M280946	H&V Unit/ HHW Coil	3/4 HP SF	NA	Room 304	Room 304	1974	-25		2014	40	15
H&V Unit	3	1	Trane	Torrivent	K4M280944	H&V Unit/ HHW Coil	3/4 HP SF	NA	Room 305	Room 305	1974	-25		2014	40	15
H&V Unit	3	1	Trane	Torrivent	K4M280945	H&V Unit/ HHW Coil	3/4 HP SF	NA	Room 306	Room 306	1974	-25		2014	40	15
AHU	3	1	Trane Climate Changer	CCDB03ANBC	K84816389	Packaged DX AHU with electric preheat	3/4 HP SF	NA	Room 306	Room 301/301A	2001	2		2014	13	15

Morris County Vocational Technical School LGEA - Building 3
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.55 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh			
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)		Retrofit control device	Notes
4LED	Hallways	Hallways	20	2B 34 R F 2 (u) (MAG)	FU2EE	72	1.44	Breaker	2280	3,283		NONE	
275LED	Buildings & Grounds Office	Offices	3	2t CFB 40/2	CFT40/2-L	72	0.22	SW	3120	674		C-OCC	
146LED	302A Veterinary Sciences	Classrooms	4	High Bay MV 400	MV400/1	455	1.82	SW	3200	5,824		NONE	
146LED	302A Veterinary Sciences	Classrooms	10	High Bay MV 400	MV400/1	455	4.55	SW	3200	14,560		NONE	
54LED	302A Veterinary Sciences	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
4LED	302A Veterinary Sciences Vestibule	Classrooms	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.07	SW	3200	230		NONE	
54LED	302A Veterinary Sciences Snake Room	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
269	302A Veterinary Sciences Mezzanine	Classrooms	2	CFS40	CFS40/1	40	0.08	SW	3200	256		NONE	
54LED	302A Veterinary Sciences Reptile Room	Classrooms	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	3200	922		NONE	
54LED	302A Veterinary Sciences Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72		C-OCC	
146LED	302 BEST Class	Classrooms	4	High Bay MV 400	MV400/1	455	1.82	SW	3200	5,824		NONE	
146LED	302 BEST Class	Classrooms	10	High Bay MV 400	MV400/1	455	4.55	SW	3200	14,560		NONE	
54LED	302 BEST Class	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
4LED	302 BEST Class	Classrooms	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.07	SW	3200	230		NONE	
54LED	302 BEST Class Vestibule	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
269	302 BEST Class Mezzanine	Classrooms	2	CFS40	CFS40/1	40	0.08	SW	3200	256		NONE	
54LED	302 BEST Class Office	Classrooms	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	3200	922		C-OCC	
54LED	302 BEST Class Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72		C-OCC	
54LED	302 BEST Class Storage	Storage Areas	6	B 34 C F 2 (MAG)	F42EE	72	0.43	SW	1000	432		NONE	
54LED	302 BEST Class Storage	Storage Areas	6	B 34 C F 2 (MAG)	F42EE	72	0.43	SW	1000	432		NONE	
54LED	Boiler Room	Mechanical Room	16	B 34 C F 2 (MAG)	F42EE	72	1.15	SW	1000	1,152		NONE	
54LED	Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72		NONE	
54LED	Faculty Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144		C-OCC	
117	Janitor's Closet	Storage Areas	2	CF 23	CFS23/1	23	0.05	SW	1000	46		NONE	
40LED	Faculty Restroom	Restrooms	2	T 32 R F 2 (ELE)	F42LL	60	0.12	SW	1000	120		C-OCC	
146LED	303 Buildings Construction	Classrooms	19	High Bay MV 400	MV400/1	455	8.65	SW	3200	27,664		NONE	
54LED	303 Buildings Construction Restroom	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
54LED	303 Buildings Construction Locker Room	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691		NONE	
54LED	303 Buildings Construction Locker Room	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
54LED	303 Buildings Construction Storage	Storage Areas	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	1000	288		NONE	
54LED	303 Buildings Construction Office	Offices	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	3120	899		C-OCC	
146LED	304 Carpentry	Classrooms	19	High Bay MV 400	MV400/1	455	8.65	SW	3200	27,664		NONE	
54LED	304 Carpentry Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144		C-OCC	
54LED	304 Carpentry Locker Room	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691		NONE	
54LED	304 Carpentry Locker Room	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461		NONE	
54LED	304 Carpentry Storage	Storage Areas	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	1000	288		NONE	
54LED	304 Carpentry Office	Offices	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	3120	899		C-OCC	
146LED	305 Electrical	Classrooms	12	High Bay MV 400	MV400/1	455	5.46	SW	3200	17,472		NONE	
54LED	305 Electrical Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72		C-OCC	
54LED	305 Electrical Locker Room	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691		NONE	
54LED	305 Electrical Storage	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216		NONE	
54LED	305 Electrical Storage	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216		NONE	
54LED	305 Sprinkler Room	Mechanical Room	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216		NONE	
275LED	305 Mezzanine	Storage Areas	4	2t CFB 40/2	CFT40/2-L	72	0.29	SW	1000	288		NONE	
54LED	305 Partial House	Classrooms	16	B 34 C F 2 (MAG)	F42EE	72	1.15	SW	3200	3,686		NONE	
146LED	306 Plumbing	Classrooms	10	High Bay MV 400	MV400/1	455	4.55	SW	3200	14,560		NONE	
54LED	306 Storage	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216		NONE	
54LED	306 Locker Room	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691		NONE	
54LED	306 Office	Offices	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3120	674		C-OCC	
269	306 Mezzanine	Storage Areas	3	CFS40	CFS40/1	40	0.12	SW	1000	120		NONE	
61LED	301 Music/Band Room	Classrooms	8	T 28 R F 3	F43SSILL	72	0.58	SW	3200	1,843		C-OCC	
61LED	301A	Classrooms	8	T 28 R F 3	F43SSILL	72	0.58	SW	3200	1,843		C-OCC	
								SW					
								SW					
								SW					
	Total		**261**				**52.15**			**155,341**			

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide Equivalent	Building Area	Annual Utility Cost		
$ 0.118	$/kWh blended		0.000420205	24,800	Electric	Natural Gas	Fuel Oil
$ 0.091	$/kWh supply	283,629	0.000420205		$ 33,455	$ 24,241	$ -
$ 6.43	$/kW	104.9	0				
$ 1.28	$/Therm	18,933	0.00533471				
$ 9.00	$/kgals	6,000	0				
$ -	$/Gal	-					

Building 3

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO_2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Replace Windows	0.0	0	1,214	0	0	1,553	$ 162,242	104.4	25	6.5	$ -	N	104.4	0.0	0	30,341	0	$ 38,837	(0.8)	($135,192)	-8.9%
Y	ECM-2	Replace Door Seals	0.0	0	437	0	0	560	$ 2,535	4.5	15	2.3	$ -	N	4.5	0.0	0	6,560	0	$ 8,397	2.3	$4,148	20.8%
Y	ECM-3	Install Condensing Boiler for Shoulder Months	0.0	0	4,204	0	0	5,381	$ 65,718	12.2	25	22.4	$ 2,625	N	11.7	0.0	0	105,091	0	$ 134,517	1.0	$30,602	6.9%
Y	ECM-4	Install Heating Hot Water Pump VFDs & Premium Motors	5.2	9,410	0	0	0	1,110	$ 8,061	7.3	15.0	4.0	$ 1,658	N	5.8	77.3	141,151	0	0	$ 22,619	1.8	$6,853	15.3%
Y	ECM-5	Replace Trane Torrivent H&V Units	0.0	10,597	0	0	0	1,250	$ 57,008	45.6	25.0	4.5	$ -	N	45.6	0.0	264,914	0	0	$ 31,260	(0.5)	($35,235)	-4.2%
Y	ECM-6	Condensing DHW Heater	0.0	0	135	0	0	173	$ 10,716	62.1	25.0	0.7	$ 50	N	61.8	0.0	0	3,370	0	$ 4,313	(0.6)	($7,661)	-6.0%
Y	ECM-7	Computer Network Controller	0.0	350	0	0	0	41	$ 1,776	43.0	15.0	0.1	$ -	N	43.0	0.0	5,250	0	0	$ 620	-0.651139	($1,283)	-11.0%
Y	ECM-8	Install Low Flow Plumbing Fixtures	0.0	0	256	0	94	1,176	$ 39,057	33.2	30.0	1.4	$ -	N	33.2	0.0	0	7,675	2,830	$ 35,294	(0.1)	($15,998)	-0.6%
N	ECM-L1	Lighting Replacements / Upgrades	37.6	114,806	0	0	0	13,349	$ 119,061	8.9	15.0	48.2	$ 11,932	N	8.0	564.0	1,722,090	0	0	$ 246,738	1.1	$52,236	9.1%
N	ECM-L2	Install Lighting Controls (Add Occupancy Sensors)	0.0	2,513	0	0	0	297	$ 3,510	11.8	15.0	1.1	$ 209	N	11.1	0.0	37,695	0	0	$ 4,448	0.3	$239	4.0%
Y	ECM-L3	Lighting Replacements with Controls (Occupancy Sensors)	37.6	116,132	0	0	0	13,470	$ 122,571	9.1	15.0	48.8	$ 12,042	N	8.2	564.0	1,741,980	0	0	$ 249,085	1.0	$50,277	8.7%
		Total (Not Including ECM L1, L2)	**42.8**	**136,489**	**6,245**	**0**	**94**	**$ 24,715**	**$ 469,684**	**19.0**	**21.1**	**91**	**$ 16,375**		**18.3**	**641**	**2,153,295**	**153,037**	**2,830**	**$ 524,942**	**0.1**	**($72,325)**	**1.3%**
		Recommended Measures (highlighted green above)	**42.8**	**136,489**	**6,245**	**0**	**94**	**$ 24,715**	**$ 469,684**	**19.0**	**21.1**	**91**	**$ 16,375**	**0**	**18.3**	**641**	**2,153,295**	**153,037**	**2,830**	**$ 524,942**	**0.1**	**($72,325)**	**1.3%**
		% of Existing	**41%**	**48.12%**	**32.99%**	**0.00%**	**1.57%**																

City: Newark, NJ

			Occupied Hours/Week	75	75	75	75	50
				Building	Auditorium	Gymnasium	Library	Classrooms
	Enthalpy			Operating	Occupied	Occupied	Occupied	Occupied
Temp	h (Btu/lb)	Bin Hours		Hours	Hours	Hours	Hours	Hours
102.5								
97.5	35.4	6		3	3	3	3	2
92.5	37.4	31		14	14	14	14	9
87.5	35.0	131		58	58	58	58	39
82.5	33.0	500		223	223	223	223	149
77.5	31.5	620		277	277	277	277	185
72.5	29.9	664		296	296	296	296	198
67.5	27.2	854		381	381	381	381	254
62.5	24.0	927		414	414	414	414	276
57.5	20.3	600		268	268	268	268	179
52.5	18.2	730		326	326	326	326	217
47.5	16.0	491		219	219	219	219	146
42.5	14.5	656		293	293	293	293	195
37.5	12.5	1,023		457	457	457	457	304
32.5	10.5	734		328	328	328	328	218
27.5	8.7	334		149	149	149	149	99
22.5	7.0	252		113	113	113	113	75
17.5	5.4	125		56	56	56	56	37
12.5	3.7	47		21	21	21	21	14
7.5	2.1	34		15	15	15	15	10
2.5	1.3	1		0	0	0	0	0
-2.5								
-7.5								

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

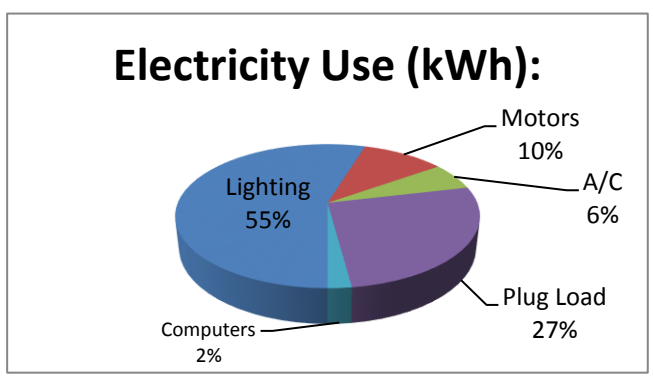
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

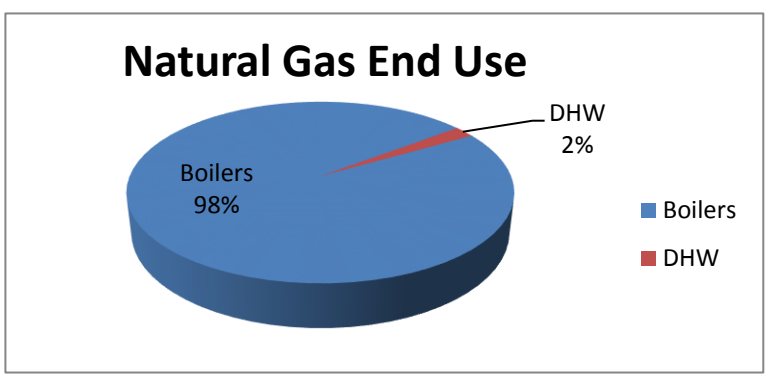
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
283,629	Total	Based on utility analysis	
155,341	Lighting	From Lighting Calculations	0.547690821
29,630	Motors	Estimated	0.104469023
17,355	A/C	Estimated	0.061189583
75,302	Plug Load	Estimated	0.265494713
6,000	Computers	Estimated	0.021154395
Natural Gas Use (Therms):		**Notes/Comments:**	
18,933	Total	Based on utility analysis	
18,549	Boilers	Therms/SF x Square Feet Served	0.979717953
384	DHW	Based on utility analysis	0.020282047





Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

Note: pricing is for energy calculations only -do not use for procurement

ECM-1: Window Replacement

Existing: Windows are not properly sealed and have a high heat gain/loss rate (U Value). This can lead to increased energy consumption due to infiltration/exfiltration and heat gain/loss.
Proposed: Replace single pane windows with new double pane windows to reduce heat gain/loss and infiltration/exfiltration

Linear Feet of window Edge	153.0	LF	Cooling System Efficiency	0	kW/ton	Heating System Efficiency	80%	
Area of window glass	878.5	SF	Ex Occupied Clng Temp.	74	*F	Heating On Temp.	60	*F
Existing Infiltration Factor	**0.25**	**cfm/LF**	Ex Unoccupied Clng Temp.	76	*F	Ex Occupied Htg Temp.	68	*F
Proposed Infiltration Factor	**0.10**	**cfm/LF**	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Ex Unoccupied Htg Temp.	58	*F
Existing U Value	**1.13**	**Btuh/SF/°F**	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.118	$/kWh
Proposed U Value	**0.45**	**Btuh/SF/°F**				Natural Gas	$ 1.28	$/therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	50.1	0	0	0	-44,844	-42,858	-12,823	-12,032	0	0	0	0
97.5	42.5	6	2	4	-34,314	-32,329	-10,323	-9,532	0	0	0	0
92.5	39.5	45	16	29	-27,154	-25,168	-8,140	-7,349	0	0	0	0
87.5	36.6	146	52	94	-20,066	-18,081	-5,963	-5,173	0	0	0	0
82.5	34.0	298	106	192	-13,198	-11,213	-3,808	-3,017	0	0	0	0
77.5	31.6	476	170	306	-6,477	-4,492	-1,666	-875	0	0	0	0
72.5	29.2	662	237	426	0	0	0	0	0	0	0	0
67.5	27.0	740	264	476	0	0	0	0	0	0	0	0
62.5	24.5	765	273	492	0	0	0	0	0	0	0	0
57.5	21.4	733	262	471	12,269	584	4,324	206	0	0	44	15
52.5	18.7	668	239	430	18,111	6,427	6,384	2,265	0	0	89	31
47.5	16.2	659	235	424	23,954	12,269	8,443	4,324	0	0	136	48
42.5	14.4	685	245	441	29,796	18,111	10,502	6,384	0	0	191	67
37.5	12.6	739	264	475	35,638	23,954	12,561	8,443	0	0	260	92
32.5	10.7	717	256	461	41,481	29,796	14,621	10,502	0	0	305	107
27.5	8.6	543	194	349	47,323	35,638	16,680	12,561	0	0	270	95
22.5	6.8	318	114	205	53,166	41,481	18,739	14,621	0	0	182	64
17.5	5.5	245	88	158	59,008	47,323	20,798	16,680	0	0	158	56
12.5	4.1	156	56	100	64,850	53,166	22,858	18,739	0	0	112	39
7.5	2.6	92	33	59	70,693	59,008	24,917	20,798	0	0	73	26
2.5	1.0	36	13	23	76,535	64,850	26,976	22,858	0	0	31	11
-2.5	0.0	19	7	12	82,377	70,693	29,035	24,917	0	0	18	6
-7.5	-1.5	8	3	5	88,220	76,535	31,095	26,976	0	0	8	3
TOTALS		**8,760**	**3,129**	**5,631**					0	0	**1,874**	**661**

Existing Window Infiltration	**163**	**cfm**
Existing Window Heat Transfer	**993**	**Btuh/°F**
Proposed Window Infiltration	**15**	**cfm**
Proposed Window Heat Transfer	**395**	**Btuh/°F**

Savings	**1,214**	**Therms**	**$**	**1,553**
	0	**kWh**	**$**	**-**
			$	**1,553**

Window ID	Location	Quantity	Width (ft)	Height (ft)	Linear Feet (LF)	Area (SF)	Infiltration Rate (CFM/LF)	U Value (Btuh/SF/°F)	Infiltration (CFM)	Heat Transfer (Btuh/°F)
1	West Wall	2	24	7	124.0	336.0	0.25	1.13	31.0	379.7
2	North Wall	16	3.5	5	272.0	280.0	0.25	1.13	68.0	316.4
3	East Wall	6	3.5	5	102.0	105.0	0.25	1.13	25.5	118.7
4	South Wall	9	3.5	5	153.0	157.5	0.25	1.13	38.3	178.0
Total		**9**	**3.5**	**5**	**153.0**	**878.5**	**1.06**	**1.13**	**162.8**	**992.7**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Window Replacement - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
New Windows	878.5	SF	$ 65	$ 65	$ -	$ 58,644	$ 71,150	$ -	$ 129,794	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 129,794	Subtotal
$ 32,448	25% Contingency
$ 162,242	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-2: Install Door Seals

Description: This ECM evaluates the thermal and electrical savings associate with adding door seals and sweeps to prevent infiltration of cold (hot) outdoor air.

Heating System Efficiency	80%		Ex Occupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Cooling System Efficiency	0.00	kW/ton	Ex Unoccupied Clng Temp.	72	*F	Ex Unoccupied Htg Temp.	72	*F
Linear Feet of Door Edge	181	LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.12	$/kWh
Existing Infiltration Factor*	1.5	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.28	$/therm
Proposed Infiltration Factor*	0.45	cfm/LF						

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	0.0	0	0	0	33,598	33,598	10,079	10,079	0	0	0	0
97.5	35.4	6	3	3	-9,661	-9,661	-2,898	-2,898	0	0	0	0
92.5	37.4	31	14	17	-12,098	-12,098	-3,629	-3,629	0	0	0	0
87.5	35.0	131	58	73	-9,144	-9,144	-2,743	-2,743	0	0	0	0
82.5	33.0	500	223	277	-6,777	-6,777	-2,033	-2,033	0	0	0	0
77.5	31.5	620	277	343	-4,945	-4,945	-1,484	-1,484	0	0	0	0
72.5	29.9	664	296	368	-2,939	-2,939	-882	-882	0	0	0	0
67.5	27.2	854	381	473	1,319	1,319	396	396	0	0	14	4
62.5	24.0	927	414	513	2,786	2,786	836	836	0	0	32	10
57.5	20.3	600	268	332	4,252	4,252	1,276	1,276	0	0	32	10
52.5	18.2	730	326	404	5,718	5,718	1,715	1,715	0	0	52	16
47.5	16.0	491	219	272	7,184	7,184	2,155	2,155	0	0	44	13
42.5	14.5	656	293	363	8,650	8,650	2,595	2,595	0	0	71	21
37.5	12.5	1,023	457	566	10,116	10,116	3,035	3,035	0	0	129	39
32.5	10.5	734	328	406	11,582	11,582	3,475	3,475	0	0	106	32
27.5	8.7	334	149	185	13,048	13,048	3,914	3,914	0	0	54	16
22.5	7.0	252	113	140	14,514	14,514	4,354	4,354	0	0	46	14
17.5	5.4	125	56	69	15,980	15,980	4,794	4,794	0	0	25	7
12.5	3.7	47	21	26	17,447	17,447	5,234	5,234	0	0	10	3
7.5	2.1	34	15	19	18,913	18,913	5,674	5,674	0	0	8	2
2.5	1.3	1	0	1	20,379	20,379	6,114	6,114	0	0	0	0
-2.5	0.0	0	0	0	21,845	21,845	6,553	6,553	0	0	0	0
-7.5	0.0	0	0	0	23,311	23,311	6,993	6,993	0	0	0	0
TOTALS		**8,760**	**3,911**	**4,849**					**0**	**0**	**625**	**187**

Existing Door Infiltration	**272**	**cfm**	
Existing Unoccupied Door Infiltration	**272**	**cfm**	
Proposed Door Infiltration	**81**	**cfm**	
Proposed Unoccupied Door Infiltration	**81**	**cfm**	

Savings			
	437	**therms**	**$ 560**
	0	**kWh**	**$ -**
			$ 560

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
1	3	7	20	0.125	all sides	13	65%	0.08125
2	3	7	20	0.125	all sides	13	65%	0.08125
3	3	7	20	0.125	all sides	13	65%	0.08125
4	3	7	20	0.125	all sides	13	65%	0.08125
5	3	7	20	0.125	all sides	13	65%	0.08125
6	3	7	20	0.125	all sides	13	65%	0.08125
7	3	7	20	0.125	all sides	13	65%	0.08125
8	3	7	20	0.125	all sides	13	65%	0.08125
9	3	7	20	0.125	all sides	13	65%	0.08125
10	8	8	32	0.125	all sides	32	100%	0.125
11	8	8	32	0.125	all sides	32	100%	0.125
Total	**43**	**79**	**244**	**0.125**		**181**	**74%**	**0.089**

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

Morris County Vocational Technical School District - LGEA
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Building 3

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-2: Install Door Seals - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Weatherization Seals & Sweeps	11	EA	$ 40	$ 115	$ -	$ 452	$ 1,576	$ -	$ 2,028	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 2,028	Subtotal
$ 507	25% Contingency
$ 2,535	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-3: Install Boiler for Shoulder Month Operation

Description: This ECM evaluates the installation of a condensing boiler to supplement the existing standard efficiency boilers with one high efficiency condensing gas boiler. The existing boiler efficiency is 80% (per NJBPU protocols) and the proposed boiler efficiency is 90% (average seasonal efficiency). Electrical power consumption due to pumps is considered to be the same for both the proposed system and the baseline system.

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.28	/ Therm	Natural Gas
Baseline Fuel Cost		/ Gal	No. 2 Oil
FORMULA CONSTANTS			
Oversize Factor	0.8		
Hours per Day	24		
Design Outdoor Temp	14	F	
Infrared Conversion Factor	1.0		1.0 if Boiler, 0.8 if Infrared Heater
EXISTING			
Capacity	3,172,000	btu/hr	Based on lower shoulder month load
Heating Combustion Efficiency	80%		(1/2 of boiler plant total capacity)
Heating Degree-Day	2,783	Degree-day	
Design Temperature Difference	56	F	
Fuel Conversion	100,000	btu/therm	
PROPOSED			
Capacity	3,172,000	btu/hr	
Efficiency	90%		
SAVINGS			
Fuel Savings	4,204	Therms	NJ Protocols Calculation
Fuel Cost Savings	$ 5,381		

Savings calculation formulas are taken from NJ Protocols document for Occupancy Controlled Thermostats

Algorithms

$$Gas\ Savings\ (Therms) = \frac{OF \times ((CAPY_{Bi} \times EFF_Q) - (CAPY_{Qi} \times EFF_B \times ICF)) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_B \times ICF \times EFF_Q}$$

Definition of Variables

OF = Oversize factor of standard boiler or furnace (OF=0.8)

$CAPY_{Bi}$ = Total input capacity of the baseline furnace, boiler or heater in Btu/hour

$CAPY_{Qi}$ = Total input capacity of the qualifying furnace, boiler or heater in Btu/hour

HDD_{mod} = HDD by zone and building type

24 = Hours/Day

ΔT = design temperature difference

HC_{fuel} = Conversion from Btu to therms of gas or gallons of oil or propane (100,000 btu/therm; 138,700 btu/gal of #2 oil; 92,000 btu/gal of propane)

EFF_Q = Efficiency of qualifying heater(s) (AFUE %)

EFF_B = Efficiency of baseline heaters (AFUE %)

ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for furnaces/boilers)[2]

Furnaces and Boilers

Component	Type	Value	Source
$AFUE_q$	Variable		Application
$AFUE_b$	Fixed	Furnaces: 78% Boilers: 80% Infrared: 78%	EPACT Standard for furnaces and boilers
$CAPY_{in}$	Variable		Application
ΔT	Variable	See Table Below	1
HDD_{mod}	Fixed	See Table Below	1

Sources:

1. KEMA, *Smartstart Program Protocol Review*. 2009.
2. http://www.spaceray.com/1_space-ray_faqs.php

Adjusted Heating Degree Days by Building Type

Building Type	Heating Energy Density (kBtu/sf)	Degree Day Adjustment Factor	Atlantic City (HDD)	Newark (HDD)	Philadelphia (HDD)	Monticello (HDD)
Education	29.5	0.55	2792	2783	2655	3886
Food Sales	35.6	0.66	3369	3359	3204	4689
Food Service	39.0	0.73	3691	3680	3510	5137
Health Care	53.6	1.00	5073	5057	4824	7060
Lodging	15.0	0.28	1420	1415	1350	1976
Retail	29.3	0.55	2773	2764	2637	3859
Office	28.1	0.52	2660	2651	2529	3701
Public Assembly	33.8	0.63	3199	3189	3042	4452
Public Order/Safety	24.1	0.45	2281	2274	2169	3174
Religious Worship	29.1	0.54	2754	2745	2619	3833
Service	47.8	0.89	4524	4510	4302	6296
Warehouse/Storage	20.2	0.38	1912	1906	1818	2661

Heating Degree Days and Outdoor Design Temperature by Zone

Weather Station	HDD	Outdoor Design Temperature (F)
Atlantic City	5073	13
Newark	5057	14
Philadelphia, PA	4824	15
Monticello, NY	7060	8

Morris County Vocational Technical School District - LGEA
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Building 3

ECM-3: Install Boiler for Shoulder Month Operation - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
1,500 MBH NG Condensing Boiler	1	EA	$ 27,500	$ 10,000		$ 28,243	$ 12,460	$ -	$ 40,703	Vendor Estimate
Flue Installation	1	EA	$3,000.0	$2,500.00		$ 3,081	$ 3,115	$ -	$ 6,196	Vendor Estimate
controls	1	EA	$ 100.0	$ 500.00		$ 103	$ 623	$ -	$ 726	RS Means 2012
Miscellaneous Electrical	1	LS	$ 1,000	$ 500		$ 1,027	$ 623	$ -	$ 1,650	RS Means 2012
Miscellaneous HW Piping	1	LS	$ 2,000	$ 1,000		$ 2,054	$ 1,246	$ -	$ 3,300	RS Means 2012
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 52,574	Subtotal
$ 13,144	25% Contingency
$ 65,718	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-4: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives

Description: This ECM evaluates the energy (electrical) savings associated with replacing existing motors with high efficiency motors (based on ASHRAE 2010 NEMA ratings) and adding variable frequency drives to control motor speed based on actual load verses constant volume / constant flow.

Variable Inputs

Electric Rate	$0.12	**$/kWh**
Demand Rate	$0.09	**$/kW**

MOTOR SCHEDULE										Savings Factor		Existing Motor Energy		Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty	HP	Total HP	Upgrade Motor	Load Factor	Existing Motor Eff.	New Motor Eff.	Annual Hours	Demand Savings Factor	Energy Savings Factor	Demand Energy (kW)	Electrical Energy (kWh)	Demand Energy (kW)	Electrical Energy (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
HHW Pumps	CHW/HW	2	5.0	10.0	N	0.75	87.5%	90.5%	2,214	0.201	0.580	6.4	14,152	1.2	4,742	5.2	9,410
															Total:	5.2	9,410.1
																$ -	$ 1,110
																	$ 1,110

Savings calculation formulas are taken from NJ Protocols document for VFDs

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-4: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.00

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
5.0 HP VFD	2	ea	$ 1,706	$ 431	$ -	$ 3,505	$ 1,073	$ -	$ 4,577	RS Means 2012
5.0 HP Motor	2	ea	$ 373	$ 79	$ -	$ 766	$ 196	$ -	$ 962	RS Means 2012
Electrical - misc.	2	ls	$ 200	$ 200	$ -	$ 411	$ 498	$ -	$ 909	RS Means 2012

$ 6,449	Subtotal
$ 1,612	25% Contingency
$ 8,061	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-5: Replace Existing Trane Torrivent Units with New H&V Units

Description: This ECM evaluates the energy (electrical) savings associated with replacing existing Trane Torrivent H&V Units with New H&V units. Due to the fact that these units do not produce heating or cooling and only utilize a HHW coil fed by the boiler, the energy savings associated with this measure is only associated with replacing the existing supply fan motors that are each approximately (1) HP with premium efficiency motors.

Variable Inputs

Electric Rate	$0.12	**$/kWh**
Demand Rate	$0.09	**$/kW**

MOTOR SCHEDULE										Savings Factor		Existing Motor Energy		Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty	HP	Total HP	Upgrade Motor	Load Factor	Existing Motor Eff.	New Motor Eff.	Annual Hours	Demand Savings Factor	Energy Savings Factor	Demand Energy (kW)	Electrical Energy (kWh)	Demand Energy (kW)	Electrical Energy (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
H&V unit Supply Fan	CHW/HW	5	1.0	5.0	N	0.75	80.0%	87.9%	4,427	0.201	0.580	3.5	15,479	0.6	4,882	2.9	10,597
															Total:	2.9	10,596.6
																$ 3	$ 1,250
																	$ 1,254

Savings calculation formulas are taken from NJ Protocols document for VFDs

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-5: Replace Existing Trane Torrivent Units with New H&V Units - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.00

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Existing H&V Unit Removal	5	ea	$ -	$ 279	$ -	$ -	$ 1,738	$ -	$ 1,738	RS Means 2012
New H&V Units	5	ea	$ 4,750	$ 890	$ -	$ 24,391	$ 5,545	$ -	$ 29,936	RS Means 2012
Electrical - misc.	5	ls	$ 1,500	$ 1,000	$ -	$ 7,703	$ 6,230	$ -	$ 13,933	RS Means 2012

$ 45,607	Subtotal
$ 11,402	25% Contingency
$ 57,008	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
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Building 3

ECM-6: Replace Gas-Fired DHW Heater with Condensing DHW Heater

Description: This ECM evaluates the energy savings associated with replacing the existing standard efficiency DHW Heater with a new high efficiency condensing natural gas fired DHW Heater. Natural Gas savings will result from improved overall system efficiency.

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	**32**	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	38,400	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	72%		Based on age and appearance
Total Annual Hot Water Demand (w/ standby losses)	27,648	MBTU/yr	
Existing Tank Size	80	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	Per building personnel
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	1.2	MBH	
Annual Standby Hot Water Load	10,549	MBTU/yr	
New Tank Size	50	Gallons	Based on AO Smith Cyclone
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.8	MBH	
Annual Standby Hot Water Load	6,826	MBTU/yr	
Total Annual Hot Water Demand	23,925	MBTU/yr	
Proposed Avg. Hot water heater efficiency	96%		Based on AO Smith Cyclone
Proposed Fuel Use	249	Therns	Standby Losses and inefficient DHW heater eliminated
Utility Cost	$1.28	$/Therm	
Existing Operating Cost of DHW	$492	$/yr	
Proposed Operating Cost of DHW	$319	$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Therms/yr	135	$173

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-6: Replace Gas-Fired DHW Heater with Condensing DHW Heater - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Gas-Fired DHW Heater Removal	1	LS	$ -	$ 150		$ -	$ 187	$ -	$ 187	RS Means 2012
Condensing DHW Heater	1	EA	$ 4,000	$ 1,500		$ 4,108	$ 1,869	$ -	$ 5,977	Vendor Pricing
Miscellaneous Electrical	1	LS	$ 300	$ 300		$ 308	$ 374	$ -	$ 682	RS Means 2012
Venting Kit	1	EA	$ 450	$ 650		$ 462	$ 810	$ -	$ 1,272	RS Means 2012
Miscellaneous Piping and Valves	1	LS	$ 200	$ 200		$ 205	$ 249	$ -	$ 455	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 8,572	Subtotal
$ 2,143	25% Contingency
$ 10,716	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-7: Computer Network Controller Savings Calculations

Notes:

1. This ECM calculates the saving associated with the installation of a centralized computer management software installed on the client server that will cause the computers to hibernate and sleep during times of low or no usage.
2. Energy savings per computer are based on manuafactures historical information from previous installations
3. There are approximately 5 computers used in this building

Background Data **Average Consumption and Savings Figures**	**kWh**
Average Total Consumption per PC per Year	500-700
Average Energy and Cost Waste per PC per Year	350-450
Average savings per PC	70
Average savings per IMac	50

Number of PCs	5
Number of IMac's	0
Return on Investment Analysis	
	kWh
Annual Energy Savings	350
Total network controller software package cost	$1,776

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-7: Computer Network Controller Savings Calculations - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Computer Network Controller Software	1	LS	$ 625	$ 625	$ -	$ 642	$ 779	$ -	$ 1,421	Vendor Estimation
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,421	Subtotal
$ 355	25% Contingency
$ 1,776	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-8: Replace toilets and flush valves with low flow

Description: This ECM evaluates the water savings associated with repalcing/ upgrading toilets to 1.28 GPF fixtures and/or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Toilets in Building	6	
Average Flushes / Toilet (per Day)	35	Based on # of occupants
Average Gallons / Flush	2.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	6	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	191.63	kGal / year
Proposed Toilet Water Use	98.11	kGal / year
Water Savings	93.51	kGal / year
Cost Savings	$842	/ year

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

ECM-8: Replace faucets with low flow

Description; This ECM evaluates the water savings resulting from replacing/ upgrading faucets to 0.5 gallon per minute flow

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Faucets in Building	6	
Average Uses / Faucet (per day)	3	Based on # of occupants
Average Time of Use	10.0	seconds
Average Flowrate	2.0	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	6	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	$ 1.28	/Therm
Number of Faucets	6	
Hours per Day of Usage	0.5	hrs
Days per Year of Facility Usage	182	days
Average Flowrate	2.0	gpm
Proposed Flowrate	0.5	gpm
Heat Content of Water	8.33	Btu/gal/F
Temperature Difference (Intake and Output)	50	F
Water Heating Equipment Efficiency	80%	
Conversion Factor	100,000	Btu/Therm
SAVINGS		
Current Faucet Water Use	1.09	kGal / year
Proposed Faucet Water Use	0.27	kGal / year
Water Savings	0.82	kGal / year
Heating Savings	256	Therms
Cost Savings	$335	/ year

Savings calculation formulas are taken from NJ Protocols document for Faucet

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

Replace Plumbing Fixtures with Low-Flow Equivalents - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Low-Flow Urinal	6	EA	$ 1,200	$ 1,000	$ -	$ 7,394	$ 7,476	$ -	$ 14,870	Vendor Estimate
Low-Flow Toilet	6	EA	$ 1,400	$ 1,000	$ -	$ 8,627	$ 7,476	$ -	$ 16,103	Vendor Estimate
Low-Flow Faucet	6	EA	$ 20	$ 20	$ -	$ 123	$ 150	$ -	$ 273	Vendor Estimate
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 31,246	Subtotal
$ 7,811	25% Contingency
$ 39,057	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 3

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	24,800
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$33,455	$24,241
Existing Usage (from utility)	283,629	18,933
Proposed Savings	136,489	6,245
Existing Total MMBtus	2,861	
Proposed Savings MMBtus	1,090	
% Energy Reduction	**38.1%**	
Proposed Annual Savings	$24,859	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$15,014	$7,807	$22,820
Incentive #3	$15,014	$7,807	$22,820
Total All Incentives	**$30,028**	**$15,613**	**$50,641**

Total Project Cost	$469,684

		Allowable Incentive
% Incentives #1 of Utility Cost*	8.7%	$5,000
% Incentives #2 of Project Cost**	4.9%	$22,820
% Incentives #3 of Project Cost**	4.9%	$22,820
Total Eligible Incentives***	**$50,641**	
Project Cost w/ Incentives	$419,043	

Project Payback (years)	
w/o Incentives	w/ Incentives
18.9	16.9

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 3
CHA Project No. 28950
ECM-L1 Lighting Replacements

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
Field Code	Area Description Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of Fixtures No. of fixtures before the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Fixt No.)	Exist Control Pre-inst. control device	Annual Hours Estimated daily hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Number of Fixtures No. of fixtures after the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Number of Fixtures)	Retrofit Control Retrofit control device	Annual Hours Estimated annual hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Annual kWh Saved (Original Annual kWh) - (Retrofit Annual kWh)	Annual kW Saved (Original Annual kW) - (Retrofit Annual kW)	Annual $ Saved (kWh Saved) * ($/kWh)	Retrofit Cost Cost for renovations to lighting system	NJ Smart Start Lighting Incentive Prescriptive Lighting Measures	Simple Payback With Out Incentive Length of time for renovations cost to be recovered	Simple Payback Length of time for renovations cost to be recovered
4LED	Hallways	20	2B 34 R F 2 (u) (MAG)	FU2EE	72	1.4	Breaker	3200	3,283	20	2T 25 R LED	2RTLED	25	0.5	Breaker	2,280	1,140	2,143	0.9	$ 267.58	$ 4,050.00	$1,000	15.1	11.4
27LED	Buildings & Grounds Office	3	2t CFB 40/2	CFT40/2-L	72	0.2	SW	3120	674	3	2T 25 R LED	2RTLED	25	0.1	SW	3,120	234	440	0.1	$ 50.92	$ 810.00	$150	15.9	13.0
14LED	302A Veterinary Sciences	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824	4	BAYLED78W	BAYLED78W	93	0.4	SW	3,200	1,190	4,634	1.4	$ 533.42	$ 3,376.78	$400	6.3	5.6
14LED	302A Veterinary Sciences	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	SW	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$1,000	6.3	5.6
54LED	302A Veterinary Sciences	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
4LED	302A Veterinary Sciences Vestibule	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230	1	2T 25 R LED	2RTLED	25	0.0	SW	3,200	80	150	0.0	$ 17.31	$ 202.50	$50	11.7	8.8
54LED	302A Veterinary Sciences Snake Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
26?	302A Veterinary Sciences Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256	2	CFS40	CFS40/1	40	0.1	SW	3,200	256	-	0.0	$ -	$ -	$0	-	#DIV/0!
54LED	302A Veterinary Sciences Reptile Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	922	4	STLED4	STLED4	40	0.2	SW	3,200	512	410	0.1	$ 47.15	$ 1,126.80	$200	23.9	19.7
54LED	302A Veterinary Sciences Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 5.38	$ 281.70	$50	52.3	43.1
14LED	302 BEST Class	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824	4	BAYLED78W	BAYLED78W	93	0.4	SW	3,200	1,190	4,634	1.4	$ 533.42	$ 3,376.78	$400	6.3	5.6
14LED	302 BEST Class	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	SW	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$1,000	6.3	5.6
54LED	302 BEST Class	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
4LED	302 BEST Class	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230	1	2T 25 R LED	2RTLED	25	0.0	SW	3,200	80	150	0.0	$ 17.31	$ 202.50	$50	11.7	8.8
54LED	302 BEST Class Vestibule	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
26?	302 BEST Class Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256	2	CFS40	CFS40/1	40	0.1	SW	3,200	256	-	0.0	$ -	$ -	$0	-	#DIV/0!
54LED	302 BEST Class Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	922	4	STLED4	STLED4	40	0.2	SW	3,200	512	410	0.1	$ 47.15	$ 1,126.80	$200	23.9	19.7
54LED	302 BEST Class Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 5.38	$ 281.70	$50	52.3	43.1
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432	6	STLED4	STLED4	40	0.2	SW	1,000	240	192	0.2	$ 32.29	$ 1,690.20	$300	52.3	43.1
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432	6	STLED4	STLED4	40	0.2	SW	1,000	240	192	0.2	$ 32.29	$ 1,690.20	$300	52.3	43.1
54LED	Boiler Room	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	1000	1,152	16	STLED4	STLED4	40	0.6	SW	1,000	640	512	0.5	$ 86.11	$ 4,507.20	$800	52.3	43.1
54LED	Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 5.38	$ 281.70	$50	52.3	43.1
54LED	Faculty Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 10.76	$ 563.40	$100	52.3	43.1
11?	Janitor's Closet	2	CF 23	CFS23/1	23	0.0	SW	1000	46	2	CF 23	CFS23/1	23	0.0	SW	1,000	46	-	0.0	$ -	$ -	$0	-	#DIV/0!
40LED	Faculty Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1000	120	2	T 38 R LED	RTLED38	38	0.1	SW	1,000	76	44	0.0	$ 7.40	$ 607.50	$100	82.1	68.6
14LED	303 Buildings Construction	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664	19	BAYLED78W	BAYLED78W	93	1.8	SW	3,200	5,654	22,010	6.9	$ 2,533.75	$ 16,039.71	$1,900	6.3	5.6
54LED	303 Buildings Construction Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
54LED	303 Buildings Construction Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 35.36	$ 845.10	$150	23.9	19.7
54LED	303 Buildings Construction Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
54LED	303 Buildings Construction Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	SW	1,000	160	128	0.1	$ 21.53	$ 1,126.80	$200	52.3	43.1
54LED	303 Buildings Construction Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	899	4	STLED4	STLED4	40	0.2	SW	3,120	499	399	0.1	$ 46.22	$ 1,126.80	$200	24.4	20.1
14LED	304 Carpentry	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664	19	BAYLED78W	BAYLED78W	93	1.8	SW	3,200	5,654	22,010	6.9	$ 2,533.75	$ 16,039.71	$1,900	6.3	5.6
54LED	304 Carpentry Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 10.76	$ 563.40	$100	52.3	43.1
54LED	304 Carpentry Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 35.36	$ 845.10	$150	23.9	19.7
54LED	304 Carpentry Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 23.58	$ 563.40	$100	23.9	19.7
54LED	304 Carpentry Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	SW	1,000	160	128	0.1	$ 21.53	$ 1,126.80	$200	52.3	43.1
54LED	304 Carpentry Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	899	4	STLED4	STLED4	40	0.2	SW	3,120	499	399	0.1	$ 46.22	$ 1,126.80	$200	24.4	20.1
14LED	305 Electrical	12	High Bay MV 400	MV400/1	455	5.5	SW	3200	17,472	12	BAYLED78W	BAYLED78W	93	1.1	SW	3,200	3,571	13,901	4.3	$ 1,600.26	$ 10,130.35	$1,200	6.3	5.6
54LED	305 Electrical Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 5.38	$ 281.70	$50	52.3	43.1
54LED	305 Electrical Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 35.36	$ 845.10	$150	23.9	19.7
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 16.15	$ 845.10	$150	52.3	43.1
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 16.15	$ 845.10	$150	52.3	43.1
54LED	305 Sprinkler Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 16.15	$ 845.10	$150	52.3	43.1
27LED	305 Mezzanine	4	2t CFB 40/2	CFT40/2-L	72	0.3	SW	1000	288	4	2T 25 R LED	2RTLED	25	0.1	SW	1,000	100	188	0.2	$ 31.62	$ 1,080.00	$200	34.2	27.8
54LED	305 Patrol House	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	SW	3,200	2,048	1,638	0.5	$ 188.61	$ 4,507.20	$800	23.9	19.7
14LED	306 Plumbing	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	SW	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$1,000	6.3	5.6
54LED	306 Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 16.15	$ 845.10	$150	52.3	43.1
54LED	306 Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 35.36	$ 845.10	$150	23.9	19.7
54LED	306 Office	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3120	674	3	STLED4	STLED4	40	0.1	SW	3,120	374	300	0.1	$ 34.67	$ 845.10	$150	24.4	20.1
26?	306 Mezzanine	3	CFS40	CFS40/1	40	0.1	SW	1000	120	3	CFS40	CFS40/1	40	0.1	SW	1,000	120	-	0.0	$ -	$ -	$0	-	#DIV/0!
61LED	301 Music/Band Room	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843	8	T 38 R LED	RTLED38	38	0.3	SW	3,200	973	870	0.3	$ 100.20	$ 2,430.00	$400	24.3	20.3
61LED	301A	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843	8	T 38 R LED	RTLED38	38	0.3	SW	3,200	973	870	0.3	$ 100.20	$ 2,430.00	$400	24.3	20.3
							SW								SW									
							SW								SW									
							SW								SW									
	Total	261			52.2				155,341	261			2,406	14.6				40,535	114,806	37.6	$13,346	$119,061	$17,000		
																		Demand Savings			37.6	$2,898		
																		kWh Savings			114,806	$10,447		
																		Total savings				$13,346	8.9	7.6

Morris County Vocational Technical School LGEA - Building 3
CHA Project No. 28950
ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
4LED	Hallways	20	2B 34 R F 2 (u) (MAG)	FU2EE	72	1.4	Breaker	2280	3,283.2	20	2B 34 R F 2 (u) (MAG)	FU2EE	72	1.4	NONE	2280	3,283.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
27SLED	Buildings & Grounds Office	3	2t CFB 40/2	CFT40/2-L	72	0.2	SW	3120	673.9	3	2t CFB 40/2	CFT40/2-L	72	0.2	C-OCC	2184	471.7	202.2	0.0	$18.40	$270.00	$35.00	14.7	12.8
146LED	302A Veterinary Sciences	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824.0	4	High Bay MV 400	MV400/1	455	1.8	NONE	3200	5,824.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
146LED	302A Veterinary Sciences	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560.0	10	High Bay MV 400	MV400/1	455	4.6	NONE	3200	14,560.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302A Veterinary Sciences	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
4LED	302A Veterinary Sciences Vestibule	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230.4	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	NONE	3200	230.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302A Veterinary Sciences Snake Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
269	302A Veterinary Sciences Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256.0	2	CFS40	CFS40/1	40	0.1	NONE	3200	256.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302A Veterinary Sciences Reptile Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	921.6	4	B 34 C F 2 (MAG)	F42EE	72	0.3	NONE	3200	921.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302A Veterinary Sciences Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	50.4	21.6	0.0	$1.97	$270.00	$35.00	137.4	119.6
146LED	302 BEST Class	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824.0	4	High Bay MV 400	MV400/1	455	1.8	NONE	3200	5,824.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
146LED	302 BEST Class	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560.0	10	High Bay MV 400	MV400/1	455	4.6	NONE	3200	14,560.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302 BEST Class	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
4LED	302 BEST Class	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230.4	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	NONE	3200	230.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302 BEST Class Vestibule	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
269	302 BEST Class Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256.0	2	CFS40	CFS40/1	40	0.1	NONE	3200	256.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302 BEST Class Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	921.6	4	B 34 C F 2 (MAG)	F42EE	72	0.3	C-OCC	2240	645.1	276.5	0.0	$25.16	$270.00	$35.00	10.7	9.3
54LED	302 BEST Class Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	50.4	21.6	0.0	$1.97	$270.00	$35.00	137.4	119.6
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432.0	6	B 34 C F 2 (MAG)	F42EE	72	0.4	NONE	1000	432.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432.0	6	B 34 C F 2 (MAG)	F42EE	72	0.4	NONE	1000	432.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Boiler Room	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	1000	1,152.0	16	B 34 C F 2 (MAG)	F42EE	72	1.2	NONE	1000	1,152.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Faculty Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	100.8	43.2	0.0	$3.93	$270.00	$35.00	68.7	59.8
117	Janitor's Closet	2	CF 23	CFS23/1	23	0.0	SW	1000	46.0	2	CF 23	CFS23/1	23	0.0	NONE	1000	46.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
40LED	Faculty Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1000	120.0	2	T 32 R F 2 (ELE)	F42LL	60	0.1	C-OCC	700	84.0	36.0	0.0	$3.28	$270.00	$35.00	82.4	71.7
146LED	303 Buildings Construction	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664.0	19	High Bay MV 400	MV400/1	455	8.6	NONE	3200	27,664.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	303 Buildings Construction Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	303 Buildings Construction Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	303 Buildings Construction Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	303 Buildings Construction Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288.0	4	B 34 C F 2 (MAG)	F42EE	72	0.3	NONE	1000	288.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	303 Buildings Construction Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	898.6	4	B 34 C F 2 (MAG)	F42EE	72	0.3	C-OCC	2184	629.0	269.6	0.0	$24.53	$270.00	$35.00	11.0	9.6
146LED	304 Carpentry	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664.0	19	High Bay MV 400	MV400/1	455	8.6	NONE	3200	27,664.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	304 Carpentry Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	100.8	43.2	0.0	$3.93	$270.00	$35.00	68.7	59.8
54LED	304 Carpentry Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	304 Carpentry Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	304 Carpentry Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288.0	4	B 34 C F 2 (MAG)	F42EE	72	0.3	NONE	1000	288.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	304 Carpentry Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	898.6	4	B 34 C F 2 (MAG)	F42EE	72	0.3	C-OCC	2184	629.0	269.6	0.0	$24.53	$270.00	$35.00	11.0	9.6
146LED	305 Electrical	12	High Bay MV 400	MV400/1	455	5.5	SW	3200	17,472.0	12	High Bay MV 400	MV400/1	455	5.5	NONE	3200	17,472.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	305 Electrical Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	50.4	21.6	0.0	$1.97	$270.00	$35.00	137.4	119.6
54LED	305 Electrical Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	305 Sprinkler Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
27SLED	305 Mezzanine	4	2t CFB 40/2	CFT40/2-L	72	0.3	SW	1000	288.0	4	2t CFB 40/2	CFT40/2-L	72	0.3	NONE	1000	288.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	305 Partial House	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686.4	16	B 34 C F 2 (MAG)	F42EE	72	1.2	NONE	3200	3,686.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
146LED	306 Plumbing	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560.0	10	High Bay MV 400	MV400/1	455	4.6	NONE	3200	14,560.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	306 Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	306 Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	306 Office	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3120	673.9	3	B 34 C F 2 (MAG)	F42EE	72	0.2	C-OCC	2184	471.7	202.2	0.0	$18.40	$270.00	$35.00	14.7	12.8
269	306 Mezzanine	3	CFS40	CFS40/1	40	0.1	SW	1000	120.0	3	CFS40	CFS40/1	40	0.1	NONE	1000	120.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
61LED	301 Music/Band Room	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843.2	8	T 28 R F 3	F43SSILL	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$50.32	$270.00	$35.00	5.4	4.7
61LED	301A	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843.2	8	T 28 R F 3	F43SSILL	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$50.32	$270.00	$35.00	5.4	4.7
							SW								0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
							SW								0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
							SW								0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
	Total	261				52.2			155341.4	261.0				52.2				152828.3	2513.1	0.0	228.7	3510.0	455.0		

Demand Savings			0.0	$0	
kWh Savings			2,513	$297	
Total Savings				$297	

Morris County Vocational Technical School LGEA - Building 3
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
4LED	Hallways	20	2B 34 R F 2 (u) (MAG)	FU2EE	72	1.4	Breaker	2280	3,283	20	2T 25 R LED	2RTLED	25	0.5	NONE	2,280	1,140	2,143	0.9	$ 267.58	$ 4,050.00	$ 1,000	15.1	11.4
27SLED	Buildings & Grounds Office	3	2t CFB 40/2	CFT40/2-L	72	0.2	SW	3120	674	3	2T 25 R LED	2RTLED	25	0.1	C-OCC	2,184	164	510	0.1	$ 57.30	$ 1,080.00	$ 185	18.8	15.6
14LED	302A Veterinary Sciences	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824	4	BAYLED78W	BAYLED78W	93	0.4	NONE	3,200	1,190	4,634	1.4	$ 533.42	$ 3,376.78	$ 400	6.3	5.6
14LED	302A Veterinary Sciences	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	NONE	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$ 1,000	6.3	5.6
54LED	302A Veterinary Sciences	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
4LED	302A Veterinary Sciences Vestibule	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230	1	2T 25 R LED	2RTLED	25	0.0	NONE	3,200	80	150	0.0	$ 17.31	$ 202.50	$ 50	11.7	8.8
54LED	302A Veterinary Sciences Snake Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
26?	302A Veterinary Sciences Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256	2	CFS40	CFS40/1	40	0.1	NONE	3,200	256	-	0.0	$ -	$ -	$ -	-	-
54LED	302A Veterinary Sciences Reptile Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	922	4	STLED4	STLED4	40	0.2	NONE	3,200	512	410	0.1	$ 47.15	$ 1,126.80	$ 200	23.9	19.7
54LED	302A Veterinary Sciences Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	C-OCC	700	28	44	0.0	$ 6.47	$ 551.70	$ 85	85.2	72.1
14LED	302 BEST Class	4	High Bay MV 400	MV400/1	455	1.8	SW	3200	5,824	4	BAYLED78W	BAYLED78W	93	0.4	NONE	3,200	1,190	4,634	1.4	$ 533.42	$ 3,376.78	$ 400	6.3	5.6
14LED	302 BEST Class	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	NONE	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$ 1,000	6.3	5.6
54LED	302 BEST Class	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
4LED	302 BEST Class	1	2B 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	3200	230	1	2T 25 R LED	2RTLED	25	0.0	NONE	3,200	80	150	0.0	$ 17.31	$ 202.50	$ 50	11.7	8.8
54LED	302 BEST Class Vestibule	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
26?	302 BEST Class Mezzanine	2	CFS40	CFS40/1	40	0.1	SW	3200	256	2	CFS40	CFS40/1	40	0.1	NONE	3,200	256	-	0.0	$ -	$ -	$ -	-	-
54LED	302 BEST Class Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3200	922	4	STLED4	STLED4	40	0.2	C-OCC	2,240	358	563	0.1	$ 61.13	$ 1,396.80	$ 235	22.8	19.0
54LED	302 BEST Class Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	C-OCC	700	28	44	0.0	$ 6.47	$ 551.70	$ 85	85.2	72.1
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432	6	STLED4	STLED4	40	0.2	NONE	1,000	240	192	0.2	$ 32.29	$ 1,690.20	$ 300	52.3	43.1
54LED	302 BEST Class Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	432	6	STLED4	STLED4	40	0.2	NONE	1,000	240	192	0.2	$ 32.29	$ 1,690.20	$ 300	52.3	43.1
54LED	Boiler Room	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	1000	1,152	16	STLED4	STLED4	40	0.6	NONE	1,000	640	512	0.5	$ 86.11	$ 4,507.20	$ 800	52.3	43.1
54LED	Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 5.38	$ 281.70	$ 50	52.3	43.1
54LED	Faculty Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	C-OCC	700	56	88	0.1	$ 12.95	$ 833.40	$ 135	64.4	53.9
11?	Janitor's Closet	2	CF 23	CFS23/1	23	0.0	SW	1000	46	2	CF 23	CFS23/1	23	0.0	NONE	1,000	46	-	0.0	$ -	$ -	$ -	-	-
40LED	Faculty Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	1000	120	2	T 38 R LED	RTLED38	38	0.1	C-OCC	700	53	67	0.0	$ 9.47	$ 877.50	$ 135	92.6	78.4
14LED	303 Buildings Construction	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664	19	BAYLED78W	BAYLED78W	93	1.8	NONE	3,200	5,654	22,010	6.9	$ 2,533.75	$ 16,039.71	$ 1,900	6.3	5.6
54LED	303 Buildings Construction Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
54LED	303 Buildings Construction Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 35.36	$ 845.10	$ 150	23.9	19.7
54LED	303 Buildings Construction Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
54LED	303 Buildings Construction Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	NONE	1,000	160	128	0.1	$ 21.53	$ 1,126.80	$ 200	52.3	43.1
54LED	303 Buildings Construction Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	899	4	STLED4	STLED4	40	0.2	C-OCC	2,184	349	549	0.1	$ 59.85	$ 1,396.80	$ 235	23.3	19.4
14LED	304 Carpentry	19	High Bay MV 400	MV400/1	455	8.6	SW	3200	27,664	19	BAYLED78W	BAYLED78W	93	1.8	NONE	3,200	5,654	22,010	6.9	$ 2,533.75	$ 16,039.71	$ 1,900	6.3	5.6
54LED	304 Carpentry Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	C-OCC	700	56	88	0.1	$ 12.95	$ 833.40	$ 135	64.4	53.9
54LED	304 Carpentry Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 35.36	$ 845.10	$ 150	23.9	19.7
54LED	304 Carpentry Locker Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 23.58	$ 563.40	$ 100	23.9	19.7
54LED	304 Carpentry Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	NONE	1,000	160	128	0.1	$ 21.53	$ 1,126.80	$ 200	52.3	43.1
54LED	304 Carpentry Office	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3120	899	4	STLED4	STLED4	40	0.2	C-OCC	2,184	349	549	0.1	$ 59.85	$ 1,396.80	$ 235	23.3	19.4
14LED	305 Electrical	12	High Bay MV 400	MV400/1	455	5.5	SW	3200	17,472	12	BAYLED78W	BAYLED78W	93	1.1	NONE	3,200	3,571	13,901	4.3	$ 1,600.26	$ 10,130.35	$ 1,200	6.3	5.6
54LED	305 Electrical Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	C-OCC	700	28	44	0.0	$ 6.47	$ 551.70	$ 85	85.2	72.1
54LED	305 Electrical Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 35.36	$ 845.10	$ 150	23.9	19.7
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 16.15	$ 845.10	$ 150	52.3	43.1
54LED	305 Electrical Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 16.15	$ 845.10	$ 150	52.3	43.1
54LED	305 Sprinkler Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 16.15	$ 845.10	$ 150	52.3	43.1
27SLED	305 Mezzanine	4	2t CFB 40/2	CFT40/2-L	72	0.3	SW	1000	288	4	2T 25 R LED	2RTLED	25	0.1	NONE	1,000	100	188	0.2	$ 31.62	$ 1,080.00	$ 200	34.2	27.8
54LED	305 Partial Hallway	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	NONE	3,200	2,048	1,638	0.5	$ 188.61	$ 4,507.20	$ 800	23.9	19.7
14LED	306 Plumbing	10	High Bay MV 400	MV400/1	455	4.6	SW	3200	14,560	10	BAYLED78W	BAYLED78W	93	0.9	NONE	3,200	2,976	11,584	3.6	$ 1,333.55	$ 8,441.96	$ 1,000	6.3	5.6
54LED	306 Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 16.15	$ 845.10	$ 150	52.3	43.1
54LED	306 Locker Room	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 35.36	$ 845.10	$ 150	23.9	19.7
54LED	306 Office	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3120	674	3	STLED4	STLED4	40	0.1	C-OCC	2,184	262	412	0.1	$ 44.89	$ 1,115.10	$ 185	24.8	20.7
26?	306 Mezzanine	3	CFS40	CFS40/1	40	0.1	SW	1000	120	3	CFS40	CFS40/1	40	0.1	NONE	1,000	120	-	0.0	$ -	$ -	$ -	-	-
61LED	301 Music/Band Room	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843	8	T 38 R LED	RTLED38	38	0.3	C-OCC	2,240	681	1,162	0.3	$ 126.76	$ 2,700.00	$ 435	21.3	17.9
61LED	301A	8	T 28 R F 3	F43SSILL	72	0.6	SW	3200	1,843	8	T 38 R LED	RTLED38	38	0.3	C-OCC	2,240	681	1,162	0.3	$ 126.76	$ 2,700.00	$ 435	21.3	17.9
							SW								0	#N/A							#VALUE!
							SW								0	#N/A							#VALUE!
							SW								0	#N/A							#VALUE!
S	Total	261				52.2			155,341	261				14.6			39,209		37.6	13,466	122,571	$17,455		
S																	Demand Savings			37.6	$2,898			
S																	kWh Savings			116,132	$10,568			
S																	Total Savings				$13,466		9.1	7.8

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

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COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

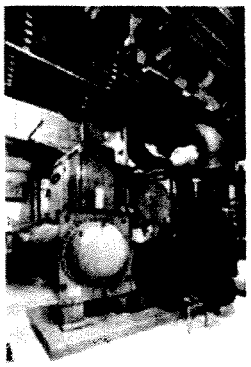
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

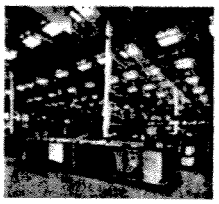
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

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New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX E

Photovoltaic Analysis

Morris County Vocational School District
Building 3

Cost of Electricity	$0.120	/kWh
Electricity Usage	322,452	kWh/yr
System Unit Cost	$4,000	/kW

Photovoltaic (PV) Solar Power Generation - Screening Assessment

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	Federal Tax Credit	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$680,000	**170.0**	**210,268**	**0**	**$25,232**	**0**	**$25,232**	**$0**	**$37,217**	**26.9**	**10.9**

** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $177 /1000kwh



Area Output*
2,211 m2
23,799 ft2

Perimeter Output*
195 m
639 ft

Available Roof Space for PV:
(Area Output - 10 ft x Perimeter) x 85%
14,795 ft2

Approximate System Size: Is the roof flat? (Yes/No) No

11.5 watt/ft2
170,146 DC watts
170 kW Enter into PV Watts

PV Watts Inputs***

Array Tilt Angle	20	Enter into PV Watts (always 20 if flat, if pitched - enter estimated roof angle)
Array Azimuth	180	Enter into PV Watts (default)
Zip Code	07834	Enter into PV Watts
DC/AC Derate Factor	0.83	Enter info PV Watts

PV Watts Output
210,268 annual kWh calculated in PV Watts program

% Offset Calc

Usage	322,452	(from utilities)
PV Generation	210,268	(generated using PV Watts)
% offset	65%	

* http://www.freemaptools.com/area-calculator.htm
** http://www.flettexchange.com
*** http://gisatnrel.nrel.gov/PVWatts_Viewer/index.html

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at http://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

Disclaimer: The PVWatts® Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department Of Energy ("DOE") and may be used for any purpose whatsoever.

The names DOE/NREL/ALLIANCE shall not be used in any representation, advertising, publicity or other manner whatsoever to endorse or promote any entity that adopts or uses the Model. DOE/NREL/ALLIANCE shall not provide

any support, consulting, training or assistance of any kind with regard to the use of the Model or any updates, revisions or new versions of the Model.

YOU AGREE TO INDEMNIFY DOE/NREL/ALLIANCE, AND ITS AFFILIATES, OFFICERS, AGENTS, AND EMPLOYEES AGAINST ANY CLAIM OR DEMAND, INCLUDING REASONABLE ATTORNEYS' FEES, RELATED TO YOUR USE, RELIANCE, OR ADOPTION OF THE MODEL FOR ANY PURPOSE WHATSOEVER. THE MODEL IS PROVIDED BY DOE/NREL/ALLIANCE "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. IN NO EVENT SHALL DOE/NREL/ALLIANCE BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO CLAIMS ASSOCIATED WITH THE LOSS OF DATA OR PROFITS, WHICH MAY RESULT FROM ANY ACTION IN CONTRACT, NEGLIGENCE OR OTHER TORTIOUS CLAIM THAT ARISES OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE MODEL.

RESULTS

210,268 kWh per Year *

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.91	13,033	1,564
February	3.51	13,963	1,676
March	4.21	18,300	2,196
April	4.19	17,337	2,080
May	5.95	24,800	2,976
June	6.27	24,662	2,959
July	5.24	21,321	2,559
August	4.75	19,355	2,323
September	5.09	20,081	2,410
October	3.55	15,038	1,805
November	2.73	11,423	1,371
December	2.49	10,955	1,315
Annual	**4.24**	**210,268**	**$ 25,234**

Location and Station Identification

Requested Location	400 east main street denville nj
Weather Data Source	(TMY3) CALDWELL/ESSEX CO., NJ 10 mi
Latitude	40.88° N
Longitude	74.28° W

PV System Specifications *(Residential)*

DC System Size	170 kW
Module Type	Premium
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.12 $/kWh
Initial Cost	4.00 $/Wdc
Cost of Electricity Generated by System	0.26 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

APPENDIX F

Photos



1: Original Smith Boilers



2: HHW Pumps



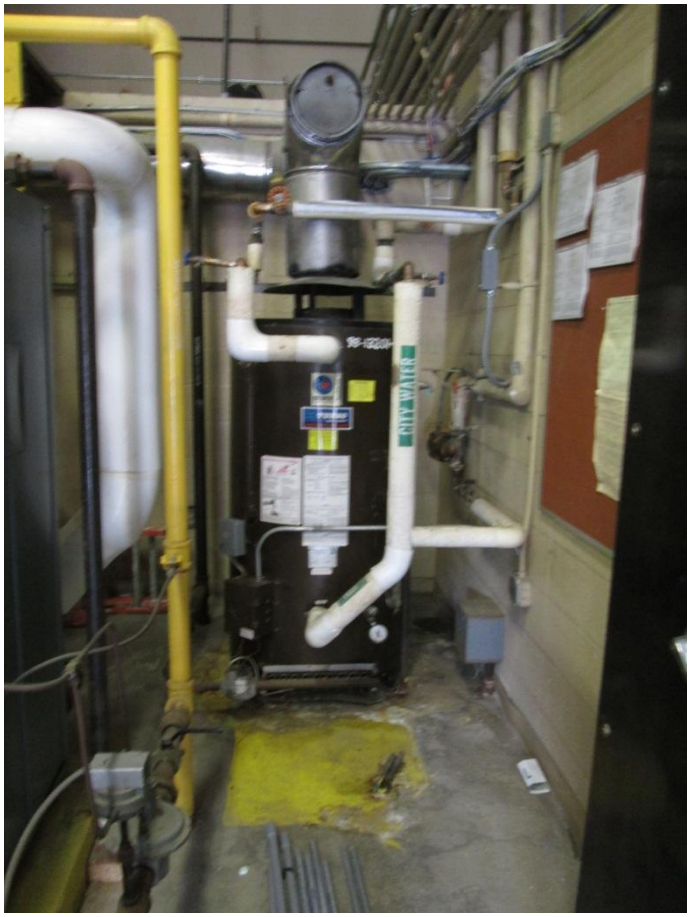
3: High Bay Mercury Vapor & CFL Lights in Shop Classroom



4: Typical Fluorescent Lighting



4: Typical Original H&V Unit



5: Original Standard Efficiency DHW Heater

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

5

ENERGY STAR® Score[1]

Building 3

Primary Property Function: K-12 School
Gross Floor Area (ft²): 24,800
Built: 1974

For Year Ending: May 31, 2014
Date Generated: October 28, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Building 3 400 East Main Street Denville, New Jersey 07834	Morris County Vocational School District 400 E Main Street Denville, NJ 07834 (____)____-_____	Mike Orlovsky 400 E Main Street Denville, NJ 07834 (518)453-3980 mdewein@chacompanies.com

Property ID: 4195898

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
115.4 kBtu/ft²

Source EUI
202.7 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	1,893,278 (66%)
Electric - Grid (kBtu)	967,749 (34%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	68.2
National Median Source EUI (kBtu/ft²)	119.9
% Diff from National Median Source EUI	69%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	230

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 4
400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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APPENDICES

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REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 4 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 4	400 E Main St, Denville, NJ 07834	79,925	1984

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
311,295	21,713	62,532	62.2

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

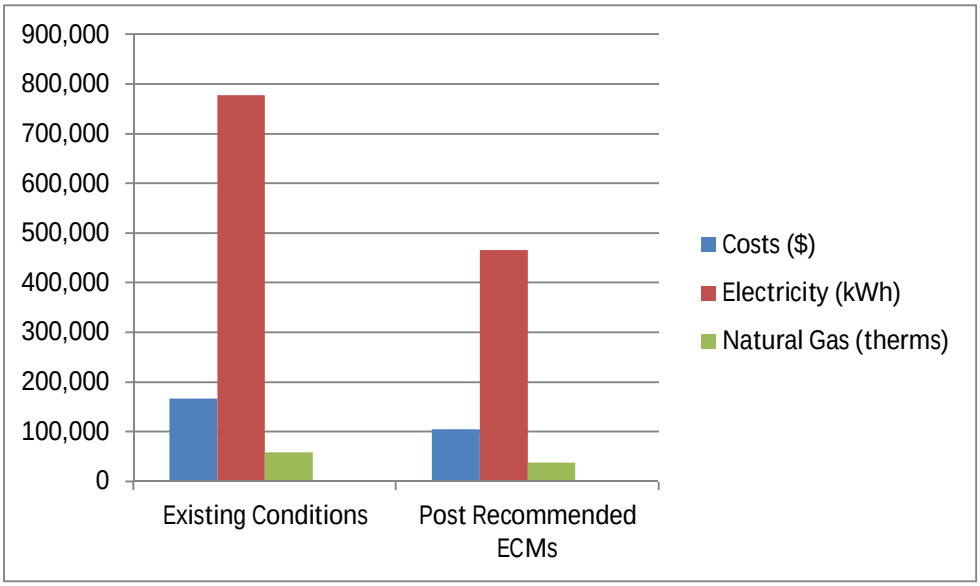
Summary of Energy Conservation Measures

ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Replace Windows	737,802	9,145	80.7	0	80.7	Y
2	Replace Door Seals	4,609	1,371	3.4	0	3.4	Y
3	Install Roof Insulation	2,499,714	16,759	149.2	0	149.2	Y
4	Replace RTUs	125,400	2,946	42.6	1,950	41.9	Y
5	Replace H&V Units	79,812	1,810	44.1	0	44.1	Y
6	Condensing DHW Heater	33,791	860	39.3	400	38.8	Y
7	Install Infrared Heaters to Replace Gas-Fired Unit Heaters	55,456	1,402	39.6	3,000	37.4	Y
8	Replace Electric Kitchen Equipment with Natural Gas	100,652	5,491	18.3	3,498	17.7	Y
9	Computer Network Controller	1,776	615	2.9	0	2.9	Y
10	Install Low Flow Plumbing Fixtures	42,185	944	44.7	0	44.7	Y
L1	Lighting Replacements / Upgrades	247,262	19,435	12.7	40,350	10.6	N
L2	Install Lighting Controls (Add Occupancy Sensors)	11,610	5,528	2.1	1,505	1.8	N
L3	Lighting Replacements with Controls (Occupancy Sensors)	258,872	21,189	12.2	41,855	10.2	Y
	Total**	3,940,069	62,532	63	50,703	62	
	Total (Recommended)	3,940,069	62,532	63	50,703	62	

* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	168,048	105,417	37%
Electricity (kWh)	777,920	466,625	40%
Natural Gas (therms)	59,725	38,012	36%
Site EUI (kbtu/SF/Yr)	107.9	67.5	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 4
Gross Floor Area: 79,925
Number of Floors: 1
Year Built: 1984
Additions: None



Description of Spaces: Votech Shops, science and culinary arts classrooms, offices, cafeteria, kitchen, computer lab, storage rooms, toilet rooms and a mechanical room.
Description of Occupancy: This building houses classroom spaces for secondary or high school level and post-secondary/adult vocational and technical education.
Number of Computers: The school has approximately 72 desktop computers.
Building Usage: The secondary school hours of operation are 8:15 AM – 3:00 PM Monday through Friday, with various post-secondary activities until 6:00 PM. Custodians are in the building until 11:00 each night. In general the occupied hours are considered 80 hours per week, 10 months per year

Building Envelope

Construction Materials: Steel framed concrete masonry unit (CMU) exterior walls
Façade: Brick and metal exterior fascia
Roof: Metal roof decking with minimal insulation, dark colored rolled asphalt. The roof appeared to be in fair condition, and an ECM for the installation of roof insulation is included.
Windows: Single pane aluminum frame windows. The windows appeared to be in poor condition, and an ECM for window replacement is included.
Exterior Doors: Single and double pane full window doors with aluminum frames. The door sweeps and seals appeared to be in poor condition and an ECM for door seal replacement is included.

Heating Ventilation & Air Conditioning (HVAC) Systems

HVAC Equipment: Heating hot water serving hot water coils in unit ventilators, cabinet heaters and heating and ventilating (H&V) units is provided by two Patterson Kelley boilers that were recently installed. Hot water is pumped through the boilers by (2) 1.5 HP primary boiler pumps and (2) 7.5 HP secondary heating loop pumps. These pumps are all new and have premium efficiency motors. Based on the capabilities of the new boilers and their controllers, it is assumed that these boilers provide hot water on a reset schedule based on outside air temperature.

Heating and ventilation for the shop classrooms is provided by original 1985 Trane H&V units. These units each have a hot water heating coil and a 1 HP supply fan motor. These units are in poor condition and have reached the end of their useful life. An ECM is included that evaluates the savings associated with this installation of new H+V units.

Exhaust: The auto body shops have several large paint booths that utilize 3 HP exhaust fans to remove paint fumes from the building. Each of the two shops also have a natural gas-fired, roof mounted make-up air (MUA) unit providing 100% outside air to replace the air exhausted by the paint booth exhaust fans. It is assumed that these units provide heating at an estimated 78% efficiency. These MUA units also appear to be original to building construction and have reached the end of their useful life.

The welding classroom has (8) additional Airflow Incorporation filtered exhaust fans to remove toxic fumes from the classroom associated with the welding process. These exhaust fans are ducted to approximately 30 moveable exhaust arms that serve each of the welding booths. This fume exhaust system is fairly new and in good condition.

The chemistry and biology labs and culinary arts classroom/kitchen area are each served by a Des Champs roof mounted heat recovery unit which utilizes a plate style heat recovery coil to reclaim some of the heat from the exhausted air from the spaces. These units heat and cool the spaces served to space set points controlled by the DDC system. These units are in good condition.

The chemistry and biology classrooms each have a dedicated packaged DX Trane RTU having natural gas heat. These units were manufactured in 2003 and are in good condition.

The culinary arts general spaces and the rest of the northeast wing of the building including the corridor and guidance offices are heated by a packaged DX Trane RTU. This unit is in poor condition and has reached the end of its useful life.

The guidance office has supplemental air conditioning provided by another cooling only Trane DX RTU. This unit was manufactured in 1999 and was not in operation during the day of the field visit. It is assumed that this unit is in poor enough condition to necessitate replacement.

An ECM has been included that evaluates the energy savings associated with the replacement of RTUs that have reached the end of their useful life.

Controls Systems

This building is being upgraded with a new campus-wide BAS control system. The spaces are currently heated to 72°F occupied and 60°F unoccupied, and cooled to 76°F occupied and 85°F unoccupied. It is assumed that this new controls system will serve the needs of the facility and will operate effectively once installation is completed, therefore no ECMs related to temperature controls are being considered.

Domestic Hot Water Systems

Domestic hot water (DHW) is generated by an AO Smith burkay copper coil boiler that is paired with a 200 gallon storage tank. This DHW system maintains 140°F hot water temperature in the tank at an estimated efficiency of 78%. The system is old and has reached the end of its useful life. This system serves lavatories, dishwashing sinks and showers in the building.

An ECM has been included to replace the existing DHW boiler and storage tank with a new high efficiency tank type condensing DHW heater.

Kitchen Equipment

The kitchen in Building 4 contains both natural gas and electric cooking appliances. All of the combination oven/range units are natural gas-fired and are in good condition. There are a total of (6) cooking appliances that are electric which consist of; (2) fryers and (4) warming ovens.

There are also several commercial and residential sized mixers used within the kitchen that are in good condition.

In general, the equipment located in the kitchen and cafeteria is in good condition. Although the equipment appears to be operating properly, an ECM has been included to replace the afforementioned electric cooking equipment with natural gas cooking equipment to provide for a utility cost reduction.

Plug Load

This school has computers with LCD monitors copiers, residential appliances (microwave, refrigerator), printers, and portable electric heaters (personal) which contribute to the plug load in the building. The installation of computer network power control software has been included as an ECM to reduce the plug loads in the building.

Plumbing Systems

The plumbing fixtures in this building are all original to building construction (1984). The water closets consume an estimated 3.0 gallons per flush (GPF) each, the urinals consume an estimated 2.0 gallons per flush and the faucets flow 2.0 gallons per minute.

An ECM is included to evaluate the water savings potential of installing low- flow water closets, urinals and faucet aerators.

Lighting Systems

The lighting consists primarily of T-12 linear fluorescent and compact fluorescent fixtures with several incandescent bulbs used in closets. Some of the more recently renovated spaces such as the science classrooms and labs have T-8 linear fluorescent fixtures. All of the older lighting systems are manually controlled by wall mounted switches. The science classrooms and labs all have occupancy sensors to allow for automatic lighting control. Although the T-8 fixtures are newer and more efficient than the T-12 fixtures, the whole building lighting is still inefficient by today's standards and can be improved upon.

Three lighting ECMs have been included which include adding occupancy sensors to the existing lighting, replacement of the T-12 and T-8 lighting with LED lighting and a third ECM that evaluates the effect of occupancy sensors used with the LED lighting upgrades.

3.0 UTILITIES

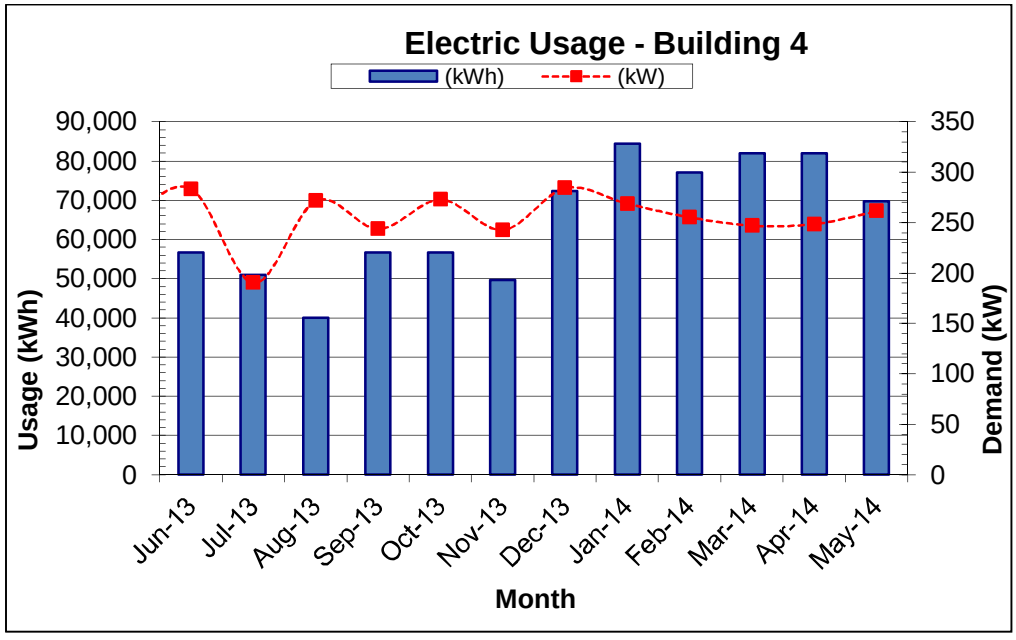
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	Direct Energy Bunsiness, LLC	New Jersey Natural Gas

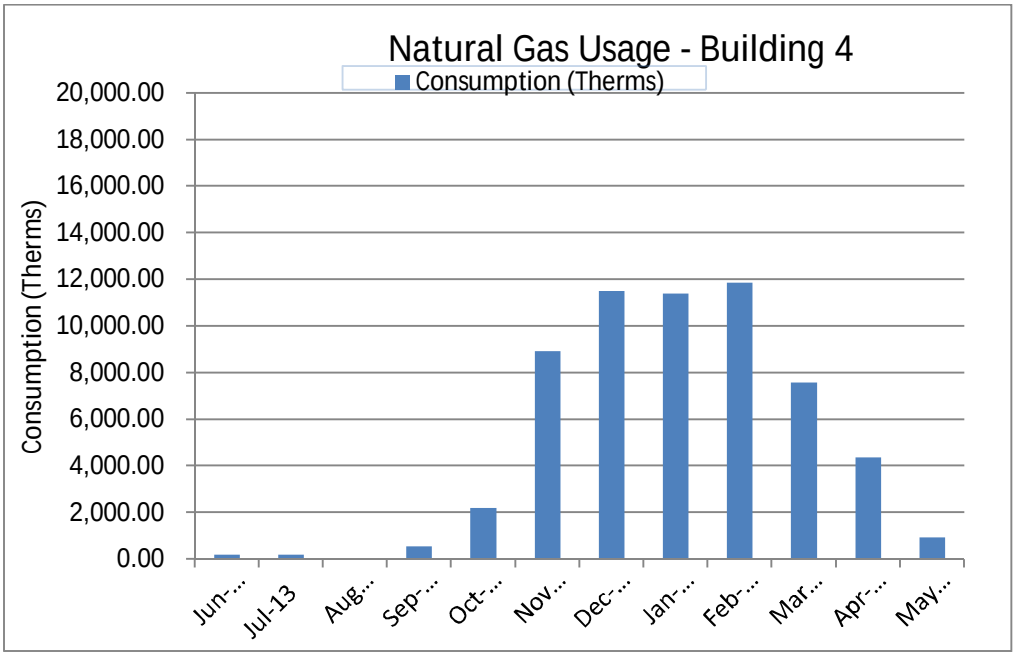
For the 12-month period ending in May 2014, the utilities usages and costs for the building were as follows:

Electric		
Annual Consumption	777,920	kWh
Annual Cost	95,001	$
Blended Unit Rate	0.122	$/kWh
Supply Rate	0.097	$/kWh
Demand Rate	3.05	$/kW
Peak Demand	284.7	kW
Natural Gas		
Annual Consumption	59,725	Therms
Annual Cost	73,047	$
Unit Rate	1.223	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



Based on the increased usage during the regular school year, it appears that plug loads from the shops and classrooms may be the primary electrical consumers in the winter months. This is a non-typical load profile for a school.



The natural gas consumption presented in the graph above is typical of a school building with peak consumption occurring during the winter months when the heating load is at it's highest. From the graph, the consumption during the summer is predominantly used for domestic water heating as the building is not being heated.

In addition, domestic water and sewer services are provided by the Township of Denville at $9.00/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.12	$0.13	N
Natural Gas	$/Therm	$1.22	$0.96	N
Fuel Oil	$/Gal	NA	$3.62	NA

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

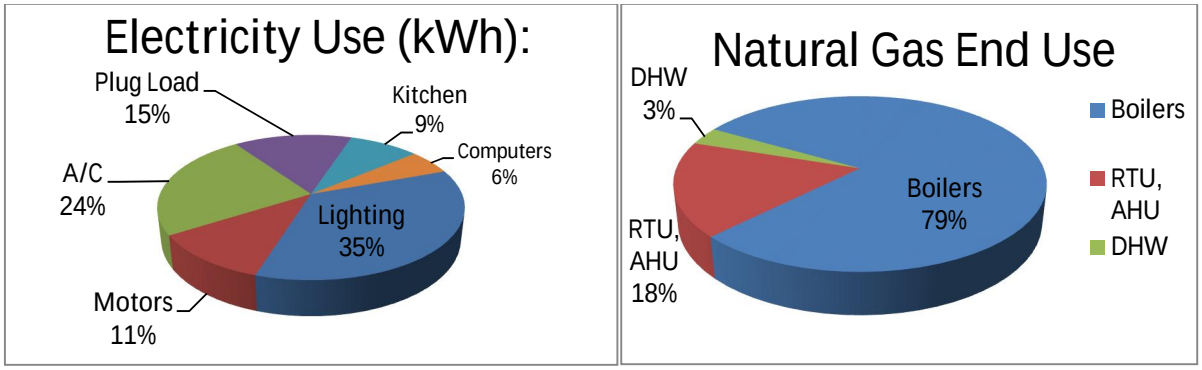
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

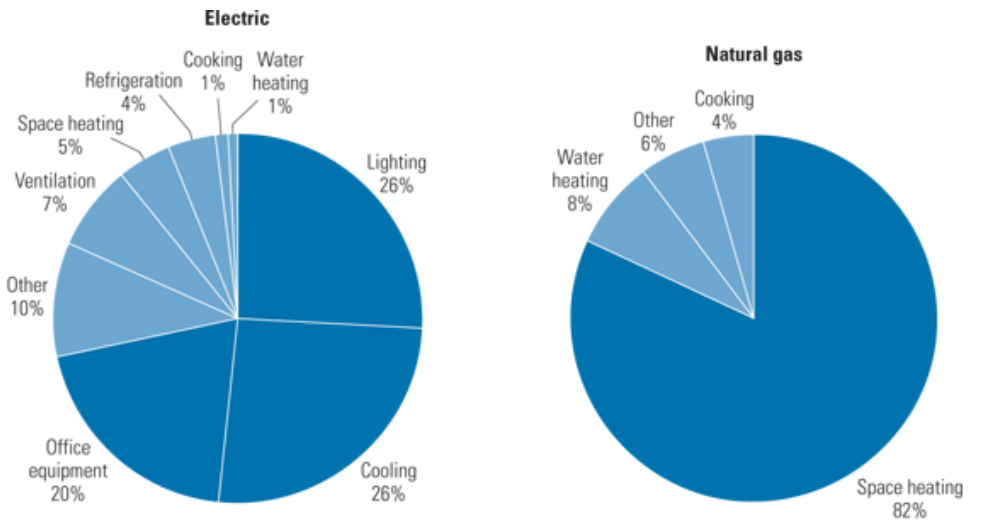
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
107.9	182.7	21

The school has a below average Energy Star Rating Score (50 being the median score), and as such by implementing the measures discussed in this report, it is expected that the EUI can be further reduced and the Energy Star Rating further increased. Additional EPA Portfolio Manager data found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Replace Windows

The existing windows are original 1985 vintage and utilize single pane glazing and aluminum frames. It is proposed to replace all of the windows at this building with new aluminum framed windows having double pane glazing and low-e coating. The new windows will reduce overall heat gain/loss and infiltration which will reduce the overall loads on the heating and cooling systems. Energy savings in the form of electricity and natural gas will result from these reduced heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Replace Windows

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
737,802	0	3,999	7,079	0	9,145	(0.7)	0	80.7	80.7

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.2 ECM-2 Replace Door Seals

The exterior doors have deteriorating sweeps and seals which allow for excessive building infiltration/exfiltration and increased heating and cooling loads. It is proposed to install new door sweeps and seals on all of the exterior doors to reduce this infiltration/exfiltration. Energy savings in the form of electricity and natural gas will result from this reduction of heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Replace Door Seals

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
4,609	0	1,553	967	0	1,371	3.5	0	3.4	3.4

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.3 ECM-3 Roof Replacement/Insulation Improvement

The roof is in poor condition and is nearing the end of its useful life. In addition to the poor condition, this roof has only minimal insulation. It is proposed to replace the existing rolled asphalt roof with an EPDM rubber membrane roof and install 3" of additional roof

insulation. Energy savings in the form of electricity and natural gas will result from increased insulation of the roof which will reduce the heating and cooling loads.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-3 Roof Replacement/Insulation Improvement

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
2,499,714	0	3,493	13,355	0	16,759	(0.8)	0	149.2	149.2

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.4 ECM-4 Replace RTUs

There are approximately (7) packaged rooftop units (RTUs) that serve this building that are nearing the end of their useful life. Four of these units utilize natural gas for heating and direct expansion (DX) refrigeration for cooling. Two of the units are make-up air units providing only heat and ventilation to the spaces. One unit is a cooling only DX rooftop unit. It is assumed that the average cooling energy efficiency rating (EER) of the cooling units is approximately 10 based on their age, and the heating efficiency is approximately 78% based on manufacturer ratings. It is proposed to replace these RTUs with new high efficiency equivalents which have an expected cooling EER of 18 and heating efficiency of 80%. Electrical and natural gas savings will result from improved efficiency ratings of the new units.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-4 Replace RTUs

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
125,400	10.4	17,493	711	0	2,946	(0.6)	1,950	42.6	41.9

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the equipment has reached the end of its useful life.

5.5 ECM-5 Replace Trane H&V units

The existing heating and ventilating (H&V) units serving the classroom spaces are original to the building and have reached the end of their useful life. Although the only energy consumed by these units is electrical energy consumed by the supply fan motors, it is proposed to replace these units with new equivalent sized H&V units having premium efficiency motors. Energy savings in the form of electricity will result from newer high efficiency motors.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-5 Replace Trane H&V Units

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
79,812	0	14,835	0	0	1,810	(0.7)	0	44.1	44.1

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the equipment has reached the end of its useful life, and it was requested by the school district.

5.6 ECM-6 Install Infrared Heaters to Replace Gas-Fired Unit Heaters

The shop classroom areas all have natural gas-fired unit heaters to supplement the H&V unit heating capacity. These unit heaters are in poor condition and appear to be original to building construction. Unit heaters heat the spaces somewhat inefficiently as they heat the air in the space. Due to the fact that the areas served have large overhead garage doors that are frequently left open, heating the space requires a high amount of natural gas consumption because the unit heaters must heat a large volume of outside air. It is proposed to replace these unit heaters with natural gas-fired infrared heaters. Infrared heaters heat objects under them as opposed to the air in the space and are considered to have a higher heating effectiveness per ASHRAE. Natural gas savings results in improved heating effectiveness and combustion efficiency of the infrared heaters as compared to the existing unit heaters.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-6 Install Infrared Heaters to Replace Gas-Fired Unit Heaters

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
55,456	0	0	1,147	0	1,402	(0.6)	3000	39.6	37.4

* Incentive based on the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.7 ECM-7 Condensing Domestic Hot Water Heater

The existing domestic hot water system consists of an AO Smith boiler serving an 200 gallon storage tank. This system has reached the end of its useful life, and its overall system efficiency can be improved. It is proposed to replace this water heater with a natural gas-fired condensing water heater of slightly less storage capacity. Condensing water heaters operate at efficiencies above 96% year-round due to the low supply water

temperature to the heaters. Natural gas savings will result from improved overall system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-7 Condensing Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
33,791	0	0	703	0	860	(0.4)	400	39.3	38.8

* Incentive based on the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as the existing water heater has reached the end of its useful life.

5.8 ECM-8 Replace Electric Kitchen Equipment with Natural Gas

There are currently (2) fryers and (4) warming ovens in the kitchen that utilize electricity for cooking or warming food. Although this equipment is in good condition, it is expensive to use them due to the high price of electricity. It is proposed to replace this electric kitchen equipment with natural gas-fired units with the same cooking and/or storage capacity. Cost savings will result from the lower cost of natural gas.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-8 Replace Electric Kitchen Equipment with Natural Gas

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
100,652	0	68,400	(2,334)	0	5,491	0.4	3,498	18.3	18.3

* Incentive based on the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.9 ECM-9 Computer Network Controller

There are approximately 72 desktop computers used in classrooms and computer rooms in the building. These computers are generally left on when the spaces are unoccupied. Although there are sleep and/or hibernate functions built into the computers, there is more advanced computer network control software which will allow for the units to reduce standby electrical energy consumption even further when the computers are not in use. Electrical energy savings will result from lower standby power draw of the computers during unoccupied hours.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-9 Computer Network Controller

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
1,776	0	5,040	0	0	615	4.2	0	2.9	2.9

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.10 ECM-10 Install Low Flow Plumbing Fixtures

The plumbing fixtures in this building are older high flow fixtures. The water savings associated from replacing existing high flow fixtures with low-flow fixtures was calculated by taking the difference of the annual water usage for the proposed and base case. The basis of this calculation is the estimate usage of each fixture, gallons per use, and number of fixtures. Replacing the existing fixtures in the restrooms with 1.28 Gals/flush toilets, 0.125 gal/flush urinals, and 0.5 gpm aerators will conserve water which will result in lower annual water and sewer charges.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-10 Install Low Flow Plumbing Fixtures

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
42,185	0	0	85	93	944	(0.3)	0	44.7	44.7

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended as it was requested by the school district.

5.11 Lighting ECMs

5.11.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of mostly T12 linear fluorescent fixtures which is an inefficient lighting system by todays standards. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A

more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
247,262	58.2	178,400	0	19,435	0.4	40,350	12.7	10.6

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is not recommended in lieu of ECM L3.

5.11.2 ECM-L2 Install Lighting Controls (Occupancy Sensors)

Presently, all interior lighting fixtures are controlled by wall mounted switches. Review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied.

This measure recommends installing occupancy sensors for the current lighting system. Using a process similar to that utilized in Section 5.7.1, the energy savings for this measure was calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L2 Install Lighting Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
11,610	0	45,309	0	5,528	6.1	1,505	2.1	1.8

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is not recommended in lieu of ECM L3.

5.11.3 ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

This measure is a combination of ECM-L1 and ECM-L2; recommending replace/upgrade the current lighting fixtures to more efficient ones and installing occupancy sensors on the new lights. Interactive effects of the higher efficiency lights and occupancy sensors lead the energy and cost savings for this measure to not be cumulative or equivalent to the sum of replacing the lighting fixtures alone and installing occupancy sensors without the

lighting upgrade. The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
258,872	58.2	196,482	0	21,189	0.5	41,855	12.2	10.2

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is recommended.

5.12 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Replace H&V Unit and RTU filters at least twice a year
- Purchase ENERGY STAR® Appliances
- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train custodians to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate students and staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.
- During the winter, Custodians should ensure all windows are closed as part of cleaning routine

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.05/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding bonds

or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. However due to insufficient roof space a photovoltaic solar array is not feasible.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

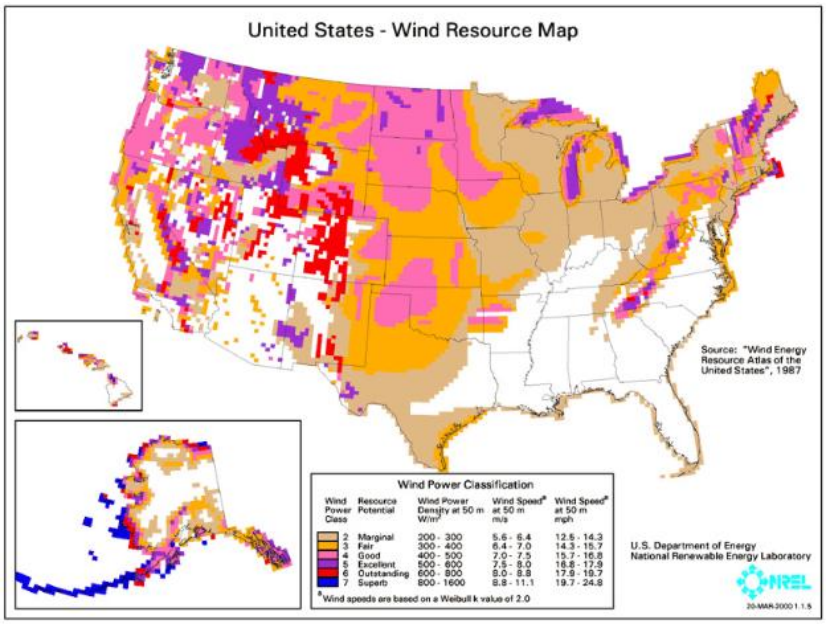
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development

Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

The school district already participates in a demand response program.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building Name.

The following projects should be considered for implementation:

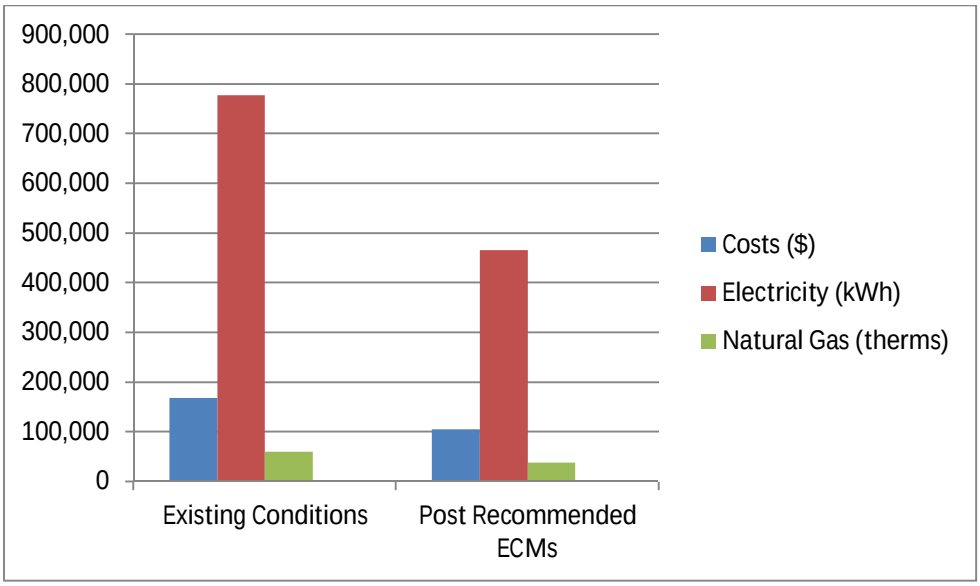
- Replace Windows
- Replace Door Seals
- Install Roof Insulation
- Replace RTUs
- Replace H&V Units
- Condensing DHW Heater
- Install Infrared Heaters to Replace Gas-Fired Unit Heaters
- Replace Electric Kitchen Equipment with Natural Gas
- Computer Network Controller
- Install Low Flow Plumbing Fixtures
- Lighting Replacements with Controls (Occupancy Sensors)

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
311,295	21,713	62,532	62.2

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	168,048	105,417	37%
Electricity (kWh)	777,920	466,625	40%
Natural Gas (therms)	59,725	38,012	36%
Site EUI (kbtu/SF/Yr)	107.9	67.5	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 4
400 East Main Street, Denville, NJ 07834

Annual Utilities
12-month Summary

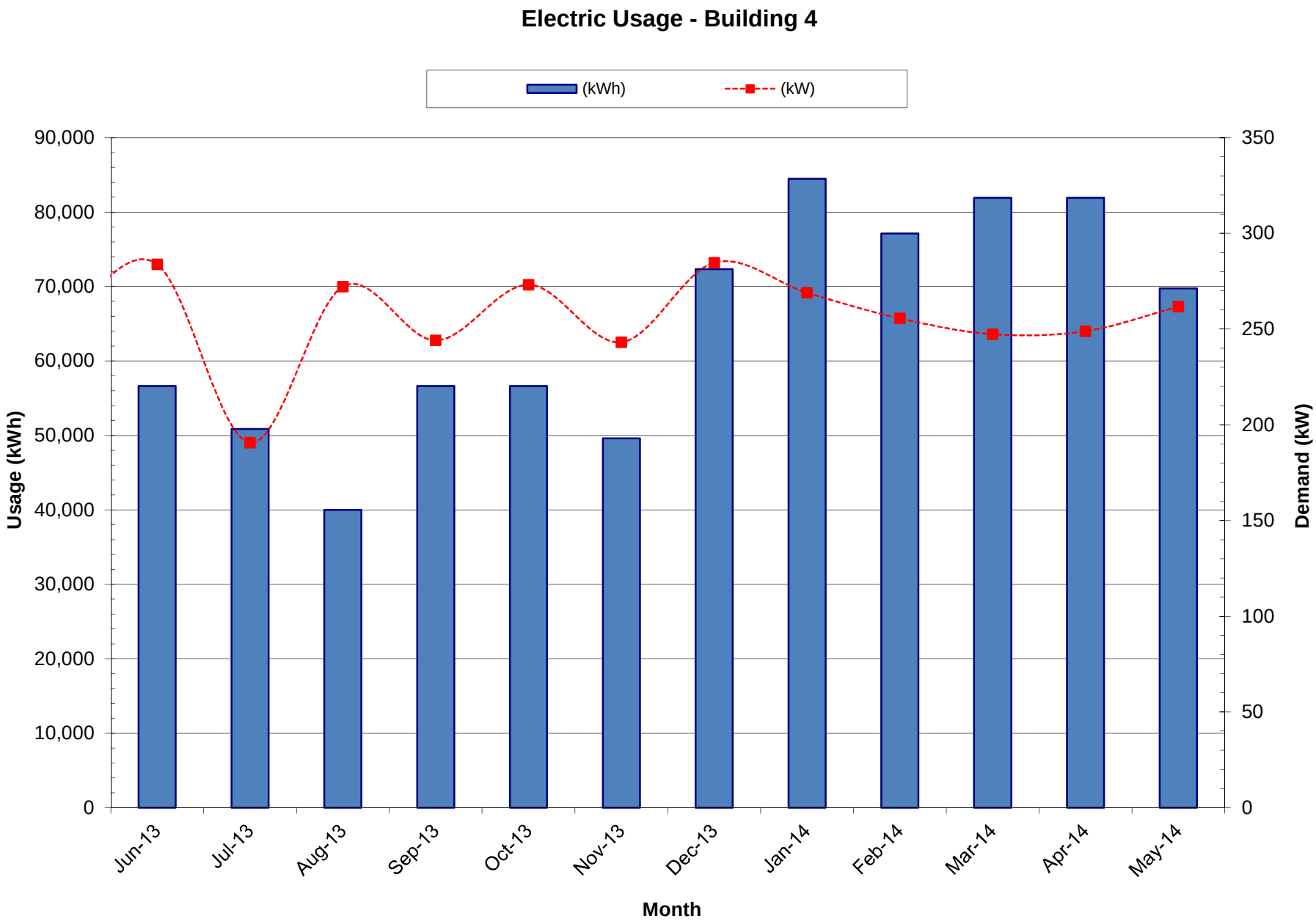
Electric		
Annual Usage	777,920	kWh/yr
Annual Cost	95,001	$
Blended Rate	0.122	$/kWh
Consumption Rate	0.097	$/kWh
Demand Rate	3.05	$/kW
Peak Demand	284.7	kW
Min. Demand	190.6	kW
Avg. Demand	259.0	kW
Natural Gas		
Annual Usage	59,725	Therms/yr
Annual Cost	73,047	$
Rate	1.223	$/therm
Water		
Annual Usage	820	kgals/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 4
400 East Main Street, Denville, NJ 07834

For Service at:
Account No.: **100000077766** **Delivery -** JCP & L
Meter No.: **G28236135** **Supplier -** Direct Energy Business, LLC
Electric Service

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	Consump. (kWh)	Demand (kW)	Delivery ($)	Supplier ($)	Total ($)	Consumption ($)	Demand ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
May-12	15,680	279.3	10,283.11		10,283.11	8,344.77	1,938.34	0.66	0.53	6.94
June-12	57,280	286.3	9,114.40		9,114.40	7,127.48	1,986.92	0.16	0.12	6.94
July-12	50,880	190.6	7,661.57		7,661.57	6,338.81	1,322.76	0.15	0.12	6.94
August-12	40,000	272.2	2,618.48	3,196.00	5,814.48	3,925.41	1,889.07	0.15	0.10	6.94
September-12	56,640	244.1	2,582.26	4,525.54	7,107.80	5,528.47	1,579.33	0.13	0.10	6.47
October-12	79,360	291.1	3,316.44		3,316.44	1,433.02	1,883.42	0.04	0.02	6.47
November-12	43,520	243.1	2,387.64		2,387.64	814.78	1,572.86	0.05	0.02	6.47
December-12	81,920	284.7	3,290.86		3,290.86	1,448.85	1,842.01	0.04	0.02	6.47
January-13	77,120	264.9	3,051.82		3,051.82	1,337.92	1,713.90	0.04	0.02	6.47
February-13	72,640	270.6	3,014.71		3,014.71	1,263.93	1,750.78	0.04	0.02	6.47
March-13	68,480	245.0	2,780.37		2,780.37	1,195.22	1,585.15	0.04	0.02	6.47
April-13	78,400	268.1	3,093.68		3,093.68	1,359.07	1,734.61	0.04	0.02	6.47
May-13	68,800	261.7	3,021.32	5,497.12	8,518.44	6,702.24	1,816.20	0.12	0.10	6.94
June-13	56,640	283.8	2,973.83	4,525.54	7,499.37	5,529.80	1,969.57	0.13	0.10	6.94
July-13	50,880	190.6	2,231.90	4,065.31	6,297.21	4,974.45	1,322.76	0.12	0.10	6.94
August-13	40,000	272.2	2,618.48	3,196.00	5,814.48	3,925.41	1,889.07	0.15	0.10	6.94
September-13	56,640	244.1	2,582.26	4,525.54	7,107.80	5,528.47	1,579.33	0.13	0.10	6.47
October-13	56,640	273.2	2,162.48	4,525.24	6,687.72	5,509.32	1,178.40	0.12	0.10	4.31
November-13	49,600	243.1	2,461.27	3,963.04	6,424.31	4,851.45	1,572.86	0.13	0.10	6.47
December-13	72,320	284.7	3,079.45	5,778.37	8,857.82	7,015.81	1,842.01	0.12	0.10	6.47
January-14	84,480	269.0	3,084.88	6,749.95	9,834.83	8,094.40	1,740.43	0.12	0.10	6.47
February-14	77,120	255.6	2,886.61	6,161.89	9,048.50	7,394.77	1,653.73	0.12	0.10	6.47
March-14	81,920	247.3	2,905.67	6,545.41	9,451.08	7,851.05	1,600.03	0.12	0.10	6.47
April-14	81,920	248.9	2,916.02	6,545.41	9,461.43	7,851.05	1,610.38	0.12	0.10	6.47
May-14	69,760	261.7	2,942.18	5,573.82	8,516.00	6,699.80	1,816.20	0.12	0.10	6.94
Total (All)	**1,568,640**	**291.10**	**$89,061.69**	**$75,374.18**	**$164,435.87**	**$122,045.75**	**$42,390.12**	**$0.10**	**$0.08**	**$6.55**
Total (last 12-months)	**777,920**	**284.70**	**$32,845.03**	**$62,155.52**	**$95,000.55**	**$75,225.78**	**$19,774.77**	**$0.122**	**$0.097**	**$3.05**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)

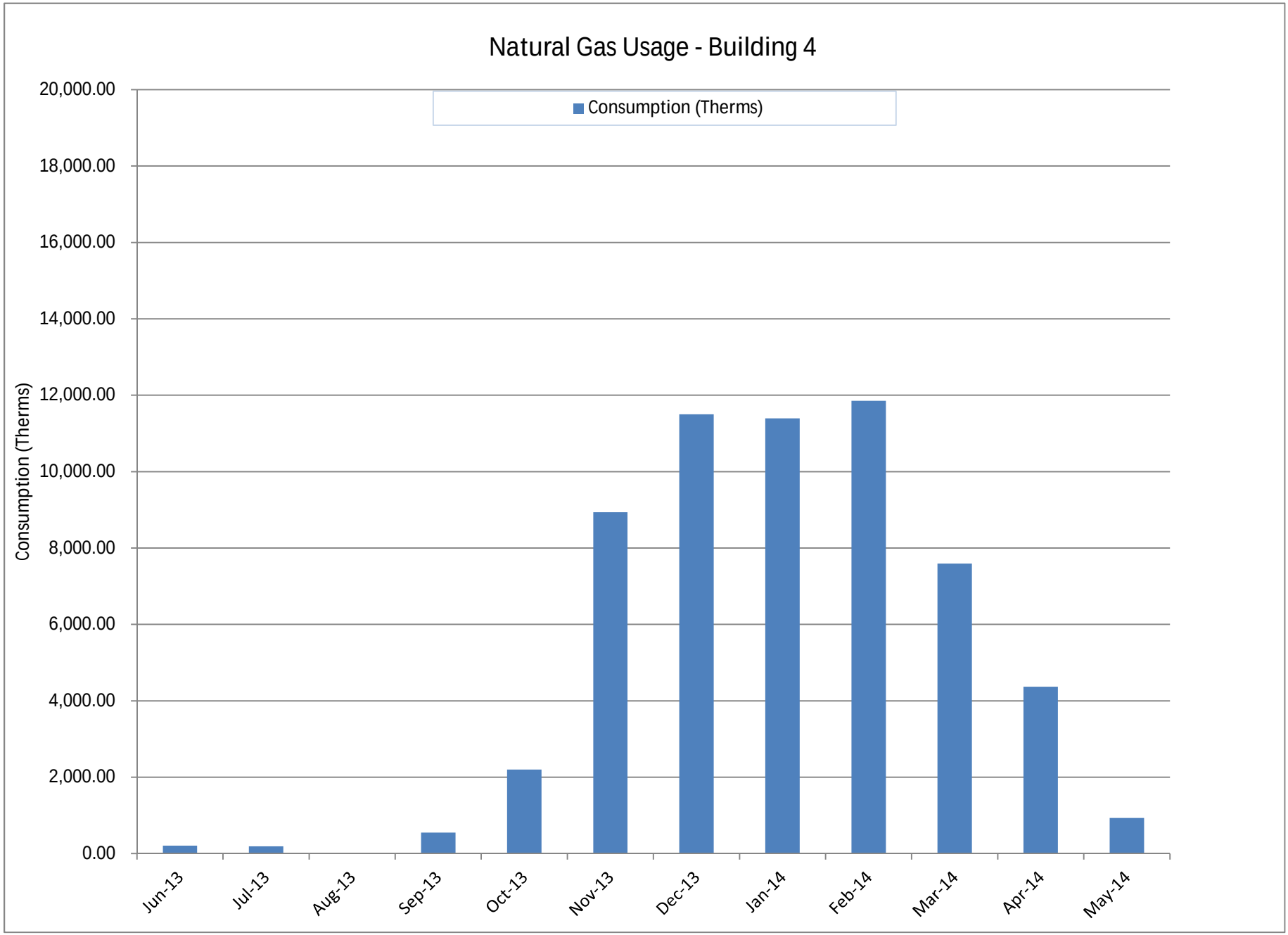


Utility Data -Building 4.xlsx
Electric Graph

Building 4
400 East Main Street, Denville, NJ 07834

For Service at: **400 East Main Street, Denville, NJ 07834**
Account No.: **181287882518**
Meter No: **892550**
Natural Gas Service **Delivery -** **New Jersey Natural Gas**
Supplier - **New Jersey Natural Gas**

		Charges		Unit Costs	
Month	**Consumption (Therms)**	**Delivery ($)**	**Total ($)**	**Delivery ($/Therm)**	**Total ($/Therm)**
June-12	151.90	$ 865.34			
July-12	358.76	$ 2,217.59			
August-12	208.86	$ 1,315.51	$ 1,315.51	$ 6.299	$ 6.299
September-12	374.44	$ 1,440.04	$ 1,440.04	$ 3.846	$ 3.846
October-12	2,543.04	$ 3,342.49	$ 3,342.49	$ 1.314	$ 1.314
November-12	13,159.22	$ 13,143.56	$ 13,143.56	$ 0.999	$ 0.999
December-12	13,659.67	$ 13,842.99	$ 13,842.99	$ 1.013	$ 1.013
January-13	10,217.36	$ 10,517.14	$ 10,517.14	$ 1.029	$ 1.029
February-13	18,157.04	$ 17,655.41	$ 17,655.41	$ 0.972	$ 0.972
March-13	7,413.61	$ 7,904.75	$ 7,904.75	$ 1.066	$ 1.066
April-13	9,664.56	$ 10,390.71	$ 10,390.71	$ 1.075	$ 1.075
May-13	1,189.18	$ 2,320.26	$ 2,320.26	$ 1.951	$ 1.951
June-13	209.89	$ 1,348.88	$ 1,348.88	$ 6.427	$ 6.427
July-13	191.13	$ -	$ -	$ -	$ -
August-13	0.00	$ 2,053.21	$ 2,053.21	$ -	$ -
September-13	551.12	$ 1,667.37	$ 1,667.37	$ 3.025	$ 3.025
October-13	2,199.26	$ 2,986.78	$ 2,986.78	$ 1.358	$ 1.358
November-13	8,935.88	$ 9,723.72	$ 9,723.72	$ 1.088	$ 1.088
December-13	11,499.65	$ 12,037.28	$ 12,037.28	$ 1.047	$ 1.047
January-14	11,393.37	$ 12,108.74	$ 12,108.74	$ 1.063	$ 1.063
February-14	11,854.84	$ 12,849.77	$ 12,849.77	$ 1.084	$ 1.084
March-14	7,590.44	$ 9,591.87	$ 9,591.87	$ 1.264	$ 1.264
April-14	4,369.01	$ 6,524.78	$ 6,524.78	$ 1.493	$ 1.493
May-14	930.73	$ 2,154.97	$ 2,154.97	$ 2.315	$ 2.315
Total (12 Months)	**59,725**		**$ 73,047.37**		**$ 1.223**


Natural Gas Usage - Building 4
Consumption (Therms)
20,000.00
18,000.00
16,000.00
14,000.00
12,000.00
10,000.00
8,000.00
6,000.00
4,000.00
2,000.00
0.00
Consumption (Therms)
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	Current year	Years Old	NJ Protocols life expectancy
Unit Ventilator	4	1	No Nameplate	No Nameplate	No Nameplate	Unit Vent with Heating Hot Water Coil	Unknown	NA	Room 401A	Room 401A	2001	2		2014	13	15
H&V Unit; HV-7	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 401	Room 401	1984	-15		2014	30	15
Unit Heater	4	2	No Nameplate	No Nameplate	No Nameplate	Unit Heater/Natural Gas	Estimated 50 MBH	NA	Room 401	Room 401	1984	-15		2014	30	15
H&V Unit; HV-6	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 402	Room 402	1984	-15		2014	30	15
Unit Heater	4	1	No Nameplate	No Nameplate	No Nameplate	Unit Heater/Natural Gas	Estimated 50 MBH	NA	Room 402	Room 402	1984	-15		2014	30	15
H&V Unit; HV-5	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 403	Room 403	1984	-15		2014	30	15
H&V Unit; HV-4	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 403	Room 404	1984	-15		2014	30	15
Unit Heater	4	2	No Nameplate	No Nameplate	No Nameplate	Unit Heater/Natural Gas	Estimated 50 MBH	NA	Room 403	Room 403	1984	-15		2014	30	15
Unit Heater	4	2	No Nameplate	No Nameplate	No Nameplate	Unit Heater/Natural Gas	Estimated 50 MBH	NA	Room 404	Room 404	1984	-15		2014	30	15
Paint Booth Exhaust	4	2	JBI Spray Booths	No Nameplate	No Nameplate	Exhaust Fan	3 HP	NA	Room 403	Room 403	1984	-15		2014	30	15
Paint Booth Exhaust	4	2	JBI Spray Booths	No Nameplate	No Nameplate	Exhaust Fan	3 HP	NA	Room 404	Room 404	1984	-15		2014	30	15
H&V Unit; HV-3	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 405	Room 405	1984	-15		2014	30	15
Unit Heater	4	2	No Nameplate	No Nameplate	No Nameplate	Unit Heater/Natural Gas	Estimated 50 MBH	NA	Room 405	Room 405	1984	-15		2014	30	15
H&V Unit; HV-2	4	1	Trane	No Nameplate	KB6-M482A	H&V Unit/ HHW Coil	1 HP SF	NA	Room 408	Room 408	1984	-15		2014	30	15
Weld Booth Exhaust	4	8	Airflow Systems, Inc.	DC5	6DC0066	Dust Drawer Exhaust Fan	Unknown	NA	Room 408	Welding Booth Exhaust	2001	2		2014	13	15
RTU-1	4	1	Rupp	DCU-25	D2593-88	100% OA Makeup Air Unit	175 MBH/ 20,000 CFM	78%	Roof	Room 403	1984	-15		2014	30	15
RTU-2	4	1	Rupp	DCU-25	D2593-89	100% OA Makeup Air Unit	175 MBH/ 20,000 CFM	78%	Roof	Room 404	1984	-15		2014	30	15
HVAC-2	4	1	Trane	SAHC02040B	J83A70102	Packaged DX RTU with Gas Heat	7.5 Ton/120 MBH	10 EER/ 80%	Roof	Room 406 & 407	1984	-15		2014	30	15
RTU-5	4	1	Des Champs	PV.MZP-8703-PVR	47117	Packaged DX HRU with Gas Heat & Plate Heat Exchanger	15 Tons/160.0 MBH/ 3,100 SCFM	12.1 EER/ 80%	Roof	Chemistry Lab 410	2003	4		2014	11	15
ACCU	4	1	Trane	TTA150B300EA	3302N	Air Cooled Condensing Unit	15 Tons	12.1 EER	Roof	RTU-5	2003	4		2014	11	15
RTU-4	4	1	Des Champs	PV.MZP-8703-PVR	47118	Packaged DX HRU with Gas Heat & Plate Heat Exchanger	15 Tons/160.0 MBH/ 3,100 SCFM	12.1 EER/ 80%	Roof	Biology Lab 412A	2003	4		2014	11	15
ACCU	4	1	Trane	TTA150B300EA	Not Accessible	Air Cooled Condensing Unit	15 Tons	12.1 EER	Roof	RTU-5	2003	4		2014	11	15
RTU-7	4	1	Trane	YHC060A3RMA16	337101871L	Packaged DX RTU with Gas Heat	5 Tons/120 MBH	12 EER/ 80%	Roof	Chemistry Classroom 417	2003	4		2014	11	15
RTU-8	4	1	Trane	YHC092A3RMA13	337101912L	Packaged DX RTU with Gas Heat	7.5 Tons/150 MBH	11 EER/ 80%	Roof	Biology Classroom 418	2003	4		2014	11	15
HVAC-1	4	1	Tane	SAH005040A43	J83A70101	Packaged DX RTU with Gas Heat	5 Tons/100 MBH	10 EER/ 80%	Roof	Culinary Arts Corridor	1984	-15		2014	30	15
HRU-1	4	1	Des Champs	PV.MZP-8703-PVR	27841	Packaged DX HRU with Gas Heat & Plate Heat Exchanger	15 Tons/160.0 MBH/ 3,100 SCFM	12.1 EER/ 80%	Roof	Culinary Arts Kitchen/Café	2003	4		2014	11	15
AC-4	4	1	Trane	TCH049C400BD	P32103411D	DX Cooling only RTU	4 Tons	10 EER	Roof	Guidance Office	1999	0		2014	15	15
Boiler	4	1	Patterson Kelley	Mach C-3000	K928-13-9560	Heating Hot Water Boiler	3000 MBH	95%	Boiler Room	Building Heat	2013	24		2014	1	25
Boiler	4	1	Patterson Kelley	Thermific N3000-MFD	GY30-13-37155	Heating Hot Water Boiler	3000 MBH	88%	Boiler Room	Building Heat	2013	24		2014	1	25
Boiler Pumps	4	1	B&G/Baldor	Super E Motor	36J875Y524E7	Boiler Primary Pump	1.5 HP	87.50%	Boiler Room	Boiler Water Circulation	2013	14		2014	1	15
HHW Pumps	4	2	B&G/Baldor	EM3311T	37F614S520G1	Heating Hot Water Pump	7.5 HP	91%	Boiler Room	Heating Hot Water Loop	2013	14		2014	1	15
DHW Boiler	4	1	AO Smith	Burkay BC-670-892	892C9112862	Domestic Hot Water Boiler	670 MBH	80%	Boiler Room	Domestic Hot Water	1989	0		2014	25	25
DHW Storage Tank	4	1	Not Accessible	Not Accessible	Not Accessible	DHW Storage Tank	200 Gallons	NA	Boiler Room	Domestic Hot Water	1989	0		2014	25	25

Morris County Vocational Technical School LGEA - Building 4
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.100** **$/kWh**
$3.05 **$/kW**

			EXISTING CONDITIONS								Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
4LED	Hallways	Hallways	54	2B 34 R F 2 (u) (MAG)	FU2EE	72	3.89	SW	2280	8,865	NONE	
54LED	401A Classroom	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
54LED	401A Classroom	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
146LED	401 Auto Class	Classrooms	15	High Bay MH 400	MH400/1	458	6.87	SW	3200	21,984	NONE	
54LED	401 Auto Class Office/Tool Storage	Classrooms	6	B 34 C F 2 (MAG)	F42EE	72	0.43	SW	3200	1,382	C-OCC	
54LED	401 Auto Class Locker/Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	401 Auto Class Storage	Classrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	3200	230	NONE	
54LED	401 Auto Class Tool Storage	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	NONE	
54LED	Nurse Exam Room	Office	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	3000	864	NONE	
117	Nurse Exam Room	Office	2	CF 23	CFS23/1	23	0.05	SW	3000	138	NONE	
247LED	Nurse Office	Office	4	T 40 R F 3 (MAG)	F43SE	136	0.54	SW	3000	1,632	C-OCC	
146LED	402A Classroom	Classrooms	8	High Bay MH 400	MH400/1	458	3.66	SW	3200	11,725	C-OCC	
54LED	402A Classroom	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
54LED	402 Auto Class	Classrooms	15	B 34 C F 2 (MAG)	F42EE	72	1.08	SW	3200	3,456	NONE	
54LED	402 Auto Class Office/Tool Storage	Classrooms	6	B 34 C F 2 (MAG)	F42EE	72	0.43	SW	3200	1,382	C-OCC	
54LED	402 Auto Class Locker/Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	402 Auto Class Storage	Classrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	3200	230	NONE	
54LED	402 Auto Class Tool Storage	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	NONE	
54LED	Boiler Room	Mechanical Room	5	B 34 C F 2 (MAG)	F42EE	72	0.36	SW	1000	360	NONE	
54LED	Electrical Room	Mechanical Room	5	B 34 C F 2 (MAG)	F42EE	72	0.36	SW	1000	360	NONE	
54LED	Phone Room	Mechanical Room	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	Storage	Storage Areas	5	B 34 C F 2 (MAG)	F42EE	72	0.36	SW	1000	360	NONE	
146LED	403 Class	Classrooms	13	High Bay MH 400	MH400/1	458	5.95	SW	3200	19,053	C-OCC	
54LED	403 Class Mezzanine	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
71	403 Paint Storage	Storage Areas	2	I 60	I60/1	60	0.12	SW	1000	120	NONE	
54LED	403 Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	403 Locker/Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	403 Tool Storage	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691	NONE	
54LED	403A Class	Classrooms	12	B 34 C F 2 (MAG)	F42EE	72	0.86	SW	3200	2,765	C-OCC	
54LED	Computer Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	Storage	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
54LED	407 Media/Library	Classrooms	42	B 34 C F 2 (MAG)	F42EE	72	3.02	SW	3200	9,677	C-OCC	
54LED	407 Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	407 Faculty Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	C-OCC	
54LED	407 Office	Office	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3000	432	C-OCC	
71	407 Office Restroom	Restrooms	1	I 60	I60/1	60	0.06	SW	1000	60	C-OCC	
54LED	407 Conference Room	Classrooms	5	B 34 C F 2 (MAG)	F42EE	72	0.36	SW	3200	1,152	C-OCC	
146LED	404 Auto Body	Classrooms	13	High Bay MH 400	MH400/1	458	5.95	SW	3200	19,053	NONE	
54LED	404 Auto Body	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691	NONE	
71	404 Auto Body	Classrooms	2	I 60	I60/1	60	0.12	SW	3200	384	NONE	
54LED	404 Auto Body	Classrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	3200	230	NONE	
54LED	404 Auto Body	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	NONE	
54LED	404 Auto Body	Classrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	3200	691	NONE	
54LED	404 Auto Body	Classrooms	12	B 34 C F 2 (MAG)	F42EE	72	0.86	SW	3200	2,765	NONE	
54LED	405a	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
54LED	405a	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
146LED	405 Classroom	Classrooms	18	High Bay MH 400	MH400/1	458	8.24	SW	3200	26,381	NONE	
54LED	405 Storage/Restroom	Restrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
71	405 Storage/Restroom	Restrooms	1	I 60	I60/1	60	0.06	SW	1000	60	NONE	
54LED	405 Locker/Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	405 Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	405 Tool Storage	Storage Areas	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	405 Mezzanine	Storage Areas	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
54LED	406 Classroom	Classrooms	6	B 34 C F 2 (MAG)	F42EE	72	0.43	SW	3200	1,382	C-OCC	
54LED	406 Classroom	Classrooms	16	B 34 C F 2 (MAG)	F42EE	72	1.15	SW	3200	3,686	C-OCC	
54LED	406 Classroom	Classrooms	16	B 34 C F 2 (MAG)	F42EE	72	1.15	SW	3200	3,686	C-OCC	
54LED	406 Classroom	Classrooms	16	B 34 C F 2 (MAG)	F42EE	72	1.15	SW	3200	3,686	C-OCC	
54LED	406 Boys Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	406 Girls Restroom	Restrooms	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	406 Storage	Storage Areas	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	406 Storage	Storage Areas	4	B 34 C F 2 (MAG)	F42EE	72	0.29	SW	1000	288	NONE	
146LED	408 Welding Class	Classrooms	15	High Bay MH 400	MH400/1	458	6.87	SW	3200	21,984	NONE	
54LED	408 Welding Booths	Classrooms	30	B 34 C F 2 (MAG)	F42EE	72	2.16	SW	3200	6,912	NONE	
54LED	408 Tool Storage	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	NONE	
54LED	408 Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	409A Classroom	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
54LED	409A Classroom	Classrooms	8	B 34 C F 2 (MAG)	F42EE	72	0.58	SW	3200	1,843	C-OCC	
218LED	410 Chemistry	Classrooms	30	W 32 P F 3 (ELE)	F43ILL/2	90	2.70	SW	3200	8,640	C-OCC	
55LED	411 Special Education	Classrooms	7	2T 17 R F 3 (ELE)	F23ILL	47	0.33	SW	3200	1,053	C-OCC	
247LED	421 Faculty Lounge	Office	9	T 40 R F 3 (MAG)	F43SE	136	1.22	SW	3000	3,672	C-OCC	
218LED	412 Biology	Classrooms	11	W 32 P F 3 (ELE)	F43ILL/2	90	0.99	SW	3200	3,168	C-OCC	

Morris County Vocational Technical School LGEA - Building 4
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.100** **$/kWh**
$3.05 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
218LED	412A Biology	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
218LED	412B	Classrooms	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.08	SW	3200	3,456	C-OCC	
54LED	413 Classroom	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	C-OCC	
247LED	414 Classroom	Classrooms	15	T 40 R F 3 (MAG)	F43SE	136	2.04	SW	3200	6,528	C-OCC	
247LED	414 Classroom	Classrooms	10	T 40 R F 3 (MAG)	F43SE	136	1.36	SW	3200	4,352	C-OCC	
247LED	414 Classroom	Classrooms	13	T 40 R F 3 (MAG)	F43SE	136	1.77	SW	3200	5,658	C-OCC	
28	414 Boys Restroom	Restrooms	1	CR 32 C F 1	FC12/1	31	0.03	SW	1000	31	NONE	
54LED	414A Computer Lab	Classrooms	12	B 34 C F 2 (MAG)	F42EE	72	0.86	SW	3200	2,765	C-OCC	
54LED	414A Storage	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
54LED	414A Storage	Storage Areas	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	Rear Hall Mens Restroom	Restrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
218LED	417 Classroom	Classrooms	18	W 32 P F 3 (ELE)	F43ILL/2	90	1.62	SW	3200	5,184	C-OCC	
54LED	417 Storage	Storage Areas	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	1000	144	NONE	
54LED	415 Culinary Arts	Classrooms	38	B 34 C F 2 (MAG)	F42EE	72	2.74	SW	3200	8,755	NONE	
54LED	415 Pantry Room	Storage Areas	1	B 34 C F 2 (MAG)	F42EE	72	0.07	SW	1000	72	NONE	
247LED	415 Office	Office	2	T 40 R F 3 (MAG)	F43SE	136	0.27	SW	3000	816	C-OCC	
54LED	415 Dishwashing Room	Classrooms	2	B 34 C F 2 (MAG)	F42EE	72	0.14	SW	3200	461	NONE	
54LED	415 Boys Locker/Restroom	Restrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
54LED	415 Girls Locker/Restroom	Restrooms	3	B 34 C F 2 (MAG)	F42EE	72	0.22	SW	1000	216	NONE	
247LED	Culinary Arts Cafeteria	Classrooms	16	T 40 R F 3 (MAG)	F43SE	136	2.18	SW	3200	6,963	C-OCC	
218LED	418 Classroom	Classrooms	32	W 32 P F 3 (ELE)	F43ILL/2	90	2.88	SW	3200	9,216	C-OCC	
254LED	Guidance Office	Office	5	CFQ26/2	CFQ26/2	66	0.33	SW	3000	990	C-OCC	
254LED	Guidance Office	Office	2	CFQ26/2	CFQ26/2	66	0.13	SW	3000	396	C-OCC	
254LED	Guidance Office	Office	3	CFQ26/2	CFQ26/2	66	0.20	SW	3000	594	C-OCC	
254LED	Guidance Office	Office	3	CFQ26/2	CFQ26/2	66	0.20	SW	3000	594	C-OCC	
254LED	Guidance Office	Office	3	CFQ26/2	CFQ26/2	66	0.20	SW	3000	594	C-OCC	
254LED	Guidance Office	Office	4	CFQ26/2	CFQ26/2	66	0.26	SW	3000	792	C-OCC	
117	Main Entrance	Hallways	6	CF 23	CFS23/1	23	0.14	SW	2280	315	NONE	
	Total		**746**				**91.05**			**275,838**		

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide	Building Area	Annual Utility Cost		
$ 0.122	$/kWh blended		0.000420205	79,925	Electric	Natural Gas	Fuel Oil
$ 0.097	$/kWh supply	777,920	0.000420205		$ 95,001	$ 73,047	$ -
$ 3.05	$/kW	284.7	0				
$ 1.22	$/Therm	59,725	0.00533471				
$ 9.00	$/kgals	6,000	0				
$ -	$/Gal	-					

Building 4

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Replace Windows	0.0	3,999	7,079	0	0	9,145	$ 737,802	80.7	25	39.4	$ -	N	80.7	0.0	99,979	176,964	0	$ 228,624	(0.7)	($578,559)	-7.5%
Y	ECM-2	Replace Door Seals	0.0	1,553	967	0	0	1,371	$ 4,609	3.4	15	5.8	$ -	N	3.4	0.0	23,291	14,498	0	$ 20,572	3.5	$11,763	29.1%
Y	ECM-3	Roof Replacement/Insulation Improvement	0.0	3,493	13,355	0	0	16,759	$ 2,499,714	149.2	25	72.7	$ -	N	149.2	0.0	87,327	333,875	0	$ 418,983	(0.8)	($2,207,882)	-10.7%
Y	ECM-4	Replace RTUs	10.4	17,493	711	0	0	2,946	$ 125,400	42.6	15	11.1	$ 1,950	N	41.9	155.4	262,392	10,671	0	$ 50,752	(0.6)	($88,279)	-10.7%
Y	ECM-5	Replace H&V Units	0.0	14,835	0	0	0	1,810	$ 79,812	44.1	15.0	6.2	$ -	N	44.1	0.0	222,528	0	0	$ 27,148	(0.7)	($58,205)	-11.2%
Y	ECM-6	Condensing DHW Heater	0.0	0	703	0	0	860	$ 33,791	39.3	25.0	3.8	$ 400	N	38.8	0.0	0	17,585	0	$ 21,507	(0.4)	($18,411)	-3.1%
Y	ECM-7	Install Infrared Heaters to Replace Gas-Fired Unit Heaters	0.0	0	1,147	0	0	1,402	$ 55,456	39.6	15.0	6.1	$ 3,000	N	37.4	0.0	0	17,198	0	$ 21,033	(0.6)	($35,717)	-9.7%
Y	ECM-8	Replace Electric Kitchen Equipment with Natural Gas	0.0	68,400	(2,334)	0	0	5,491	$ 100,652	18.3	25.0	16.3	$ 3,498	N	17.7	0.0	1,710,000	(58,345)	0	$ 137,264	0.4	($1,546)	2.9%
Y	ECM-9	Computer Network Controller	0.0	5,040	0	0	0	615	$ 1,776	2.9	15.0	2.1	$ -	N	2.9	0.0	75,600	0	0	$ 9,223	4.193883	$5,565	34.2%
Y	ECM-10	Install Low Flow Plumbing Fixtures	0.0	0	85	0	93	944	$ 42,185	44.7	30.0	0.5	$ -	N	44.7	0.0	0	2,558	2,799	$ 28,317	(0.3)	($23,684)	-2.4%
N	ECM-L1	Lighting Replacements / Upgrades	58.2	178,400	0	0	0	19,435	$ 247,262	12.7	15.0	75.0	$ 40,350	N	10.6	873.0	2,676,000	0	0	$ 358,424	0.4	$25,101	4.6%
N	ECM-L2	Install Lighting Controls (Add Occupancy Sensors)	0.0	45,309	0	0	0	5,528	$ 11,610	2.1	15.0	19.0	$ 1,505	N	1.8	0.0	679,635	0	0	$ 82,915	6.1	$55,884	54.6%
Y	ECM-L3	Lighting Replacements with Controls (Occupancy Sensors)	58.2	196,482	0	0	0	21,189	$ 258,872	12.2	15.0	82.6	$ 41,855	N	10.2	873.0	2,947,230	0	0	$ 391,514	0.5	$35,934	5.2%
		Total (Not Including ECM L1, L2)	**68.6**	**311,295**	**21,713**	**0**	**93**	**$ 62,532**	**$ 3,940,069**	**63.0**	**20.0**	**247**	**$ 50,703**		**62.2**	**1,028**	**5,428,347**	**515,004**	**2,799**	**$ 1,354,937**	**(0.7)**	**($2,959,041)**	**-9.0%**
		Recommended Measures (highlighted green above)	**68.6**	**311,295**	**21,713**	**0**	**93**	**$ 62,532**	**$ 3,940,069**	**63.0**	**20.0**	**247**	**$ 50,703**	**0**	**62.2**	**1,028**	**5,428,347**	**515,004**	**2,799**	**$ 1,354,937**	**(0.7)**	**($2,959,041)**	**-9.0%**
		% of Existing	**24%**	**40.02%**	**36.35%**	**0.00%**	**1.55%**																

	City:	Newark, NJ				
	Occupied Hours/Week	75	75	75	75	50
		Building	Auditorium	Gymnasium	Library	Classrooms
Temp	Enthalpy ft (Btu/lb)	Bin Hours	Operating Hours	Occupied Hours	Occupied Hours	Occupied Hours	Occupied Hours
102.5							
97.5	35.4	6	3	3	3	3	2
92.5	37.4	31	14	14	14	14	9
87.5	35.0	131	58	58	58	58	39
82.5	33.0	500	223	223	223	223	149
77.5	31.5	620	277	277	277	277	185
72.5	29.9	664	296	296	296	296	198
67.5	27.2	854	381	381	381	381	254
62.5	24.0	927	414	414	414	414	276
57.5	20.3	600	268	268	268	268	179
52.5	18.2	730	326	326	326	326	217
47.5	16.0	491	219	219	219	219	146
42.5	14.5	656	293	293	293	293	195
37.5	12.5	1,023	457	457	457	457	304
32.5	10.5	734	328	328	328	328	218
27.5	8.7	334	149	149	149	149	99
22.5	7.0	252	113	113	113	113	75
17.5	5.4	125	56	56	56	56	37
12.5	3.7	47	21	21	21	21	14
7.5	2.1	34	15	15	15	15	10
2.5	1.3	1	0	0	0	0	0
-2.5							
-7.5							

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

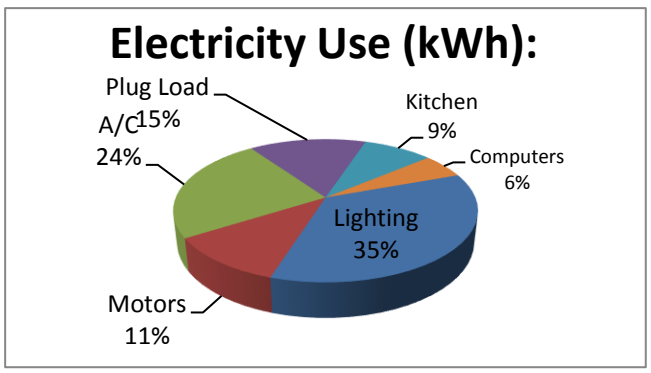
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

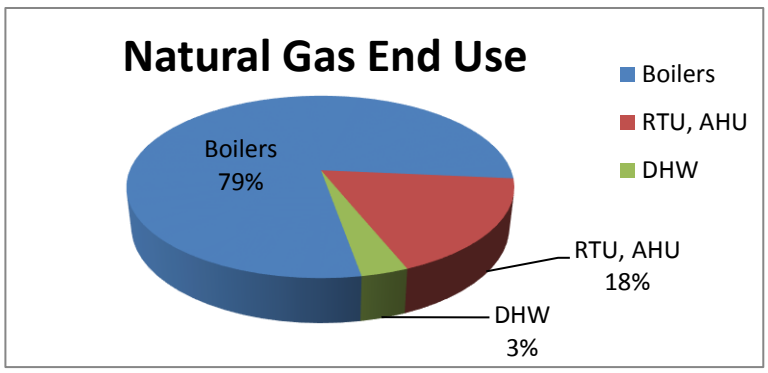
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
777,920	Total	Based on utility analysis	
275,838	Lighting	From Lighting Calculations	0.354584019
86,680	Motors	Estimated	0.111425476
188,486	A/C	See Window AC Calculation	0.242294195
115,316	Plug Load	Estimated	0.148236828
68,400	Kitchen	Estimated	0.087926779
43,200	Computers	Estimated	0.055532703
Natural Gas Use (Therms):		**Notes/Comments:**	
59,725	Total	Based on utility analysis	
57,325	Boilers	Therms/SF x Square Feet Served	0.959815823
12,635	RTU, AHU	Based on utility analysis	0.211558825
2,400	DHW	Based on utility analysis	0.040184177





Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

Note: pricing is for energy calculations only -do not use for procurement

ECM-1: Window Replacement

Existing: Windows are not properly sealed and have a high heat gain/loss rate (U Value). This can lead to increased energy consumption due to infiltration/exfiltration and heat gain/loss.
Proposed: Replace single pane windows with new double pane windows to reduce heat gain/loss and infiltration/exfiltration

Linear Feet of window Edge	3,058.0	LF	Cooling System Efficiency	1.2	kW/ton	Heating System Efficiency	80%	
Area of window glass	3,995.0	SF	Ex Occupied Clng Temp.	72	*F	Heating On Temp.	55	*F
Existing Infiltration Factor	**0.25**	**cfm/LF**	Ex Unoccupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Proposed Infiltration Factor	**0.10**	**cfm/LF**	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Ex Unoccupied Htg Temp.	72	*F
Existing U Value	**1.13**	**Btuh/SF/°F**	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.122	$/kWh
Proposed U Value	**0.45**	**Btuh/SF/°F**				Natural Gas	$ 1.22	$/therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Window Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	50.1	0	0	0	-215,437	-215,437	-85,931	-85,931	0	0	0	0
97.5	42.5	6	2	4	-166,720	-166,720	-66,484	-66,484	100	40	0	0
92.5	39.5	45	16	29	-133,827	-133,827	-53,367	-53,367	602	240	0	0
87.5	36.6	146	52	94	-101,279	-101,279	-40,388	-40,388	1479	590	0	0
82.5	34.0	298	106	192	-69,762	-69,762	-27,821	-27,821	2080	829	0	0
77.5	31.6	476	170	306	-38,934	-38,934	-15,530	-15,530	1854	740	0	0
72.5	29.2	662	237	426	-8,106	-8,106	-3,238	-3,238	537	214	0	0
67.5	27.0	740	264	476	0	0	0	0	0	0	0	0
62.5	24.5	765	273	492	0	0	0	0	0	0	0	0
57.5	21.4	733	262	471	0	0	0	0	0	0	0	0
52.5	18.7	668	239	430	104,130	104,130	41,496	41,496	0	0	870	347
47.5	16.2	659	235	424	130,830	130,830	52,136	52,136	0	0	1,078	430
42.5	14.4	685	245	441	157,530	157,530	62,776	62,776	0	0	1,349	538
37.5	12.6	739	264	475	184,230	184,230	73,416	73,416	0	0	1,703	678
32.5	10.7	717	256	461	210,930	210,930	84,057	84,057	0	0	1,891	754
27.5	8.6	543	194	349	237,630	237,630	94,697	94,697	0	0	1,614	643
22.5	6.8	318	114	205	264,330	264,330	105,337	105,337	0	0	1,051	419
17.5	5.5	245	88	158	291,031	291,031	115,977	115,977	0	0	892	355
12.5	4.1	156	56	100	317,731	317,731	126,617	126,617	0	0	620	247
7.5	2.6	92	33	59	344,431	344,431	137,257	137,257	0	0	396	158
2.5	1.0	36	13	23	371,131	371,131	147,897	147,897	0	0	167	67
-2.5	0.0	19	7	12	397,831	397,831	158,537	158,537	0	0	95	38
-7.5	-1.5	8	3	5	424,531	424,531	169,177	169,177	0	0	42	17
TOTALS		**8,760**	**3,129**	**5,631**					6653	2654	**11,768**	**4,690**

Existing Window Infiltration	**765**	**cfm**
Existing Window Heat Transfer	**4,514**	**Btuh/°F**
Proposed Window Infiltration	**306**	**cfm**
Proposed Window Heat Transfer	**1,798**	**Btuh/°F**

Savings	**7,079**	**Therms**	**$**	**8,657**
	3,999	**kWh**	**$**	**488**
			$	**9,145**

Window ID	Location	Quantity	Width (ft)	Height (ft)	Linear Feet (LF)	Area (SF)	Infiltration Rate (CFM/LF)	U Value (Btuh/SF/°F)	Infiltration (CFM)	Heat Transfer (Btuh/°F)
1	Exterior Wall	64	8	5	1664.0	2560.0	0.25	1.13	416.0	2892.8
2	Exterior Wall	82	3.5	5	1394.0	1435.0	0.25	1.13	348.5	1621.6
Total		**146**	**11.5**	**10**	**3,058.0**	**3,995.0**	**0.25**	**1.13**	**764.5**	**4514.4**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Window Replacement - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
New Windows	3995	SF	$ 65	$ 65	$ -	$ 266,686	$ 323,555	$ -	$ 590,241	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 590,241	Subtotal
$ 147,560	25% Contingency
$ 737,802	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-2: Install Door Seals

Description: This ECM evaluates the thermal and electrical savings associate with adding door seals and sweeps to prevent infiltration of cold (hot) outdoor air.

Heating System Efficiency	80%		Ex Occupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Cooling System Efficiency	1.20	kW/ton	Ex Unoccupied Clng Temp.	72	*F	Ex Unoccupied Htg Temp.	72	*F
Linear Feet of Door Edge	400	LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.12	$/kWh
Existing Infiltration Factor*	1.5	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.22	$/therm
Proposed Infiltration Factor*	0.45	cfm/LF						

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	0.0	0	0	0	74,250	74,250	22,275	22,275	0	0	0	0
97.5	35.4	6	3	3	-21,350	-21,350	-6,405	-6,405	13	4	0	0
92.5	37.4	31	14	17	-26,735	-26,735	-8,021	-8,021	83	25	0	0
87.5	35.0	131	58	73	-20,209	-20,209	-6,063	-6,063	265	79	0	0
82.5	33.0	500	223	277	-14,977	-14,977	-4,493	-4,493	749	225	0	0
77.5	31.5	620	277	343	-10,929	-10,929	-3,279	-3,279	678	203	0	0
72.5	29.9	664	296	368	-6,496	-6,496	-1,949	-1,949	431	129	0	0
67.5	27.2	854	381	473	2,916	2,916	875	875	0	0	31	9
62.5	24.0	927	414	513	6,156	6,156	1,847	1,847	0	0	71	21
57.5	20.3	600	268	332	9,396	9,396	2,819	2,819	0	0	70	21
52.5	18.2	730	326	404	12,636	12,636	3,791	3,791	0	0	115	35
47.5	16.0	491	219	272	15,876	15,876	4,763	4,763	0	0	97	29
42.5	14.5	656	293	363	19,116	19,116	5,735	5,735	0	0	157	47
37.5	12.5	1,023	457	566	22,356	22,356	6,707	6,707	0	0	286	86
32.5	10.5	734	328	406	25,596	25,596	7,679	7,679	0	0	235	70
27.5	8.7	334	149	185	28,836	28,836	8,651	8,651	0	0	120	36
22.5	7.0	252	113	140	32,076	32,076	9,623	9,623	0	0	101	30
17.5	5.4	125	56	69	35,316	35,316	10,595	10,595	0	0	55	17
12.5	3.7	47	21	26	38,556	38,556	11,567	11,567	0	0	23	7
7.5	2.1	34	15	19	41,796	41,796	12,539	12,539	0	0	18	5
2.5	1.3	1	0	1	45,036	45,036	13,511	13,511	0	0	1	0
-2.5	0.0	0	0	0	48,276	48,276	14,483	14,483	0	0	0	0
-7.5	0.0	0	0	0	51,516	51,516	15,455	15,455	0	0	0	0
TOTALS		**8,760**	**3,911**	**4,849**					**2,218**	**665**	**1,381**	**414**

Existing Door Infiltration	**600**	**cfm**	**Savings**	**967**	**therms**	**$ 1,182**
Existing Unoccupied Door Infiltration	**600**	**cfm**		**1,553**	**kWh**	**$ 189**
Proposed Door Infiltration	**180**	**cfm**				**$ 1,371**
Proposed Unoccupied Door Infiltration	**180**	**cfm**				

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
1	3	7	20	0.125	all sides	20	100%	0.125
2	3	7	20	0.125	all sides	20	100%	0.125
3	3	7	20	0.125	all sides	20	100%	0.125
4	3	7	20	0.125	all sides	20	100%	0.125
5	3	7	20	0.125	all sides	20	100%	0.125
6	3	7	20	0.125	all sides	20	100%	0.125
7	3	7	20	0.125	all sides	20	100%	0.125
8	3	7	20	0.125	all sides	20	100%	0.125
9	3	7	20	0.125	all sides	20	100%	0.125
10	3	7	20	0.125	all sides	20	100%	0.125
11	3	7	20	0.125	all sides	20	100%	0.125
12	3	7	20	0.125	all sides	20	100%	0.125
13	3	7	20	0.125	all sides	20	100%	0.125
14	3	7	20	0.125	all sides	20	100%	0.125
15	3	7	20	0.125	all sides	20	100%	0.125
16	3	7	20	0.125	all sides	20	100%	0.125
17	3	7	20	0.125	all sides	20	100%	0.125
18	3	7	20	0.125	all sides	20	100%	0.125
19	3	7	20	0.125	all sides	20	100%	0.125
20	3	7	20	0.125	all sides	20	100%	0.125
Total	**60**	**140**	**400**	**0.125**		**400**	**100%**	**0.125**

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-2: Install Door Seals - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Weatherization Seals & Sweeps	20	EA	$ 40	$ 115	$ -	$ 822	$ 2,866	$ -	$ 3,687	RS Means 2012
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 3,687	Subtotal
$ 922	25% Contingency
$ 4,609	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-3 Install New Roof Having Additional Roof Insulation

Existing: The existing roof has minimal tapered insulation which results in increased energy consumption due to heat gain/loss.
Proposed: Install 3" of additional roof insulation when roof is repaired

Area of roof	79,925	SF	Cooling System Efficiency	1.20	kW/ton	Heating System Efficiency	80%	
Existing Infiltration Factor	**0.03**	**cfm/SF**	Ex Occupied Clng Temp.	72	*F	Heating On Point	55	*F
Proposed Infiltration Factor	**0.02**	**cfm/SF**	Ex Unoccupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F
Existing U Value	**0.101**	**Btuh/SF/°F**	Cooling Occ Enthalpy Setpoint	28.26	Btu/lb	Ex Unoccupied Htg Temp.	72	*F
Proposed U Value	**0.050**	**Btuh/SF/°F**	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.122	$/kWh
						Natural Gas	$ 1.22	$/Therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Roof Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	41.1	0.0	0.0	0.0	-384,368	-392,569	-191,157	-195,257	0	0	0	0
97.5	40.8	1.0	1.0	0.0	-341,069	-349,270	-169,676	-173,776	34	17	0	0
92.5	41.7	7.0	7.0	0.0	-309,765	-317,966	-154,192	-158,292	217	108	0	0
87.5	39.3	45.0	45.0	0.0	-244,127	-252,328	-121,541	-125,642	1099	547	0	0
82.5	34.5	175.0	175.0	0.0	-151,514	-159,714	-75,403	-79,503	2651	1320	0	0
77.5	31.5	312.0	312.0	0.0	-79,211	-87,411	-39,420	-43,520	2471	1230	0	0
72.5	29.0	404.0	404.0	0.0	-11,946	-20,146	-5,956	-10,056	483	241	0	0
67.5	27.4	725.0	725.0	0.0	0	0	0	0	0	0	0	0
62.5	24.6	862.0	862.0	0.0	0	0	0	0	0	0	0	0
57.5	21.6	824.0	824.0	0.0	0	0	0	0	0	0	0	0
52.5	19.2	674.0	674.0	0.0	207,664	207,664	103,175	103,175	0	0	1,750	869
47.5	16.7	530.0	530.0	0.0	260,911	260,911	129,630	129,630	0	0	1,729	859
42.5	14.8	750.0	750.0	0.0	314,159	314,159	156,086	156,086	0	0	2,945	1,463
37.5	12.6	908.0	908.0	0.0	367,406	367,406	182,541	182,541	0	0	4,170	2,072
32.5	10.7	890.0	890.0	0.0	420,653	420,653	208,996	208,996	0	0	4,680	2,325
27.5	8.9	580.0	580.0	0.0	473,900	473,900	235,451	235,451	0	0	3,436	1,707
22.5	7.2	392.0	392.0	0.0	527,148	527,148	261,906	261,906	0	0	2,583	1,283
17.5	5.5	339.0	339.0	0.0	580,395	580,395	288,361	288,361	0	0	2,459	1,222
12.5	3.9	243.0	243.0	0.0	633,642	633,642	314,817	314,817	0	0	1,925	956
7.5	2.5	77.0	77.0	0.0	686,889	686,889	341,272	341,272	0	0	661	328
2.5	1.3	20.0	20.0	0.0	740,137	740,137	367,727	367,727	0	0	185	92
-2.5	0.5	2.0	2.0	0.0	793,384	793,384	394,182	394,182	0	0	20	10
-7.5	0.3	0.0	0.0	0.0	846,631	846,631	420,637	420,637	0	0	0	0
TOTALS		**8,760**	**8,760**	**0**					6955	3462	**26,542**	**13,187**

Existing Roof Infiltration	**2,398**	**cfm**
Existing Roof Heat Transfer	**8,060**	**Btuh/°F**
Proposed Roof Infiltration	**1,199**	**cfm**
Proposed Roof Heat Transfer	**3,996**	**Btuh/°F**

Savings	**13,355**	**Therm**	**$ 16,333**
	3,493	**kWh**	**$ 426**
			$ 16,759

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-3 Install New Roof Having Additional Roof Insulation - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Existing Roof Removal	79,925	SF	$ -	$ -	$ 2.25	$ -	$ -	$ 202,130	$ 202,130	RS Means 2012
3" Additional Rigid Tapered Insulation	79,925	SF	$ 0.98	$ 0.48	$ -	$ 80,441	$ 47,802	$ -	$ 128,243	RS Means 2012
EPDM Roof Membrane	79,925	SF	$ 12.00	$ 6.25	$ 0.69	$ 984,996	$ 622,416	$ 61,987	$ 1,669,398	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,999,771	Subtotal
$ 499,943	25% Contingency
$ 2,499,714	**Total**

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-4: Replace RTUs With More Efficient RTUs

Description: This ECM evaluates the energy savings associated with replacing older less efficient heating and cooling equipment with modern high efficiency unitary equipment havings the same capacity

Equipment Tag	Equipment Description	General Type	Cooling Capacity (Btu/h)	Heating Capacity (Btu/h)
RTU-1	RTU	HVAC	-	175,000
RTU-2	RTU	HVAC	-	175,000
HVAC-1	RTU	HVAC	90,000	120,000
HVAC-2	RTU	HVAC	60,000	100,000
AC-4	RTU	HVAC	48,000	-
RTU-7	RTU	HVAC	60,000	93,150
RTU-8	RTU	HVAC	90,000	150,000

Item	Value	Units	Formula/Comments	
Demand Rate	$ 3.05	/ kW		
Electricity Rate	$ 0.10	/kWh		
Natural Gas Rate	$ 1.22	/Therm		
FORMULA CONSTANTS				
Coincidence Factor	0.67		NJ Protocols	
Conversion	3.412	btu/kW		
COOLING - HVAC				
Cooling Capacity	348,000	btu/hr		btuh
Baseline EER	10.0		See Table Below	EERb
Proposed EER	18.0		Proposed Equipment	EERq
Equivalent Full Load Hours	1,131	hrs	NJ Protocols	
Demand Savings	10.36	kW		
Energy Savings	17,493	kWh		
HEATING - HVAC				
Heating Capacity	813,150	btu/h		
Baseline Heating Efficiency	78%		Based on age and condition of equipment	
Proposed Heating Efficiency	80%		Proposed Equipment	
Equivalent Full Load Hours	800	hrs	NJ Protocols	
Heating Savings	711.40	Therms		
SAVINGS				
Demand Savings	10.36	kW		
Natural Gas Energy Savings	711.40	Therms		
Electric Energy Savings	17,493	kWh		
Cost Savings	$ 2,946			

Savings calculation formulas are taken from NJ Protocols document for Electric HVAC Equipment

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-4: Replace RTUs With More Efficient RTUs - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Existing (19) RTUs demolition	7	EA		$ 575		$ -	$ 5,015	$ -	$ 5,015	RS Means 2012
(2) RTUs, 7.5 ton packaged units	2	EA	$ 7,650	$ 1,625		$ 15,713	$ 4,050	$ -	$ 19,763	RS Means 2012
(2) RTUs, 5.0 ton packaged units	2	EA	$ 4,975	$ 1,425		$ 10,219	$ 3,551	$ -	$ 13,770	RS Means 2012
(1) RTUs, 4.0 ton packaged units	1	EA	$ 4,250	$ 1,325		$ 4,365	$ 1,651	$ -	$ 6,016	RS Means 2012
(2) H&V RTUs, 175 MBH Gas Heat	2	EA	$ 11,400	$ 1,150		$ 23,416	$ 2,866	$ -	$ 26,281	RS Means 2012
- Reprogram DDC system for (7) RTUs	7	EA	$ 75	$ 300		$ 539	$ 2,617	$ -	$ 3,156	RS Means 2012
Crane Rental	1	LS	$ -	$ -	$ 5,000	$ -	$ -	$ 5,620	$ 5,620	
Electrical - misc.	1	LS	$ 5,000	$ 12,500		$ 5,135	$ 15,575	$ -	$ 20,710	RS Means 2012

$ 100,330	Subtotal
$ 25,083	25% Contingency
$ 125,400	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-5: Replace Existing Trane Torrivent Units with New H&V Units

Description: This ECM evaluates the energy (electrical) savings associated with replacing existing Trane Torrivent H&V Units with New H&V units. Due to the fact that these units do not produce heating or cooling and only utilize a HHW coil fed by the boiler, the energy savings associated with this measure is only associated with replacing the existing supply fan motors that are each approximately (1) HP with premium efficiency motors.

Variable Inputs

Electric Rate	$0.12	**$/kWh**
Demand Rate	$0.10	**$/kW**

MOTOR SCHEDULE										Savings Factor		Existing Motor Energy		Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty	HP	Total HP	Upgrade Motor	Load Factor	Existing Motor Eff.	New Motor Eff.	Annual Hours	Demand Savings Factor	Energy Savings Factor	Demand Energy (kW)	Electrical Energy (kWh)	Demand Energy (kW)	Electrical Energy (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
H&V unit Supply Fan	CHW/HW	7	1.0	7.0	N	0.75	80.0%	87.9%	4,427	0.201	0.580	4.9	21,670	0.9	6,835	4.0	14,835
															Total:	4.0	14,835.2
																$ 5	$ 1,810
																	$ 1,815

Savings calculation formulas are taken from NJ Protocols document for VFDs

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-5: Replace Existing Trane Torrivent Units with New H&V Units - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Existing H&V Unit Removal	7	ea	$ -	$ 279	$ -	$ -	$ 2,433	$ -	$ 2,433	RS Means 2012
New H&V Units	7	ea	$ 4,750	$ 890	$ -	$ 34,148	$ 7,763	$ -	$ 41,910	RS Means 2012
Electrical - misc.	7	ls	$ 1,500	$ 1,000	$ -	$ 10,784	$ 8,722	$ -	$ 19,506	RS Means 2012

$ 63,849	Subtotal
$ 15,962	25% Contingency
$ 79,812	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-6: Replace Gas-Fired DHW Boiler with Condensing DHW heater

Description: This ECM evaluates the energy savings associated with replacing the existing standard efficiency DHW boiler and storage tank with a new high efficiency condensing natural gas fired DHW boiler and new indirect storage tanks. Natural Gas savings will result from improved overall system efficiency.

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	**200**	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	240,000	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	72%		Based on age and appearance
Total Annual Hot Water Demand (w/ standby losses)	172,800	MBTU/yr	
Existing Tank Size	200	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	Per building personnel
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	2.9	MBH	
Annual Standby Hot Water Load	25,441	MBTU/yr	
New Tank Size	120	Gallons	
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	˚F	
Room Temperature	72	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	1.8	MBH	
Annual Standby Hot Water Load	15,513	MBTU/yr	
Total Annual Hot Water Demand	162,872	MBTU/yr	
Proposed Avg. Hot water heater efficiency	96%		AO Smith Cyclone
Proposed Fuel Use	1,697	Therns	Standby Losses and inefficient DHW heater eliminated
Utility Cost	$1.22	$/Therm	
Existing Operating Cost of DHW	$2,935	$/yr	
Proposed Operating Cost of DHW	$2,075	$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Therms/yr	703	$860

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-6: Replace Gas-Fired DHW Boiler with Condensing DHW heater - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Gas-Fired DHW Heater Removal	1	LS		$ 575		$ -	$ 716	$ -	$ 716	RS Means 2012
Condensing DHW Boiler (Mach N Roll)	1	EA	$ 15,000	$ 5,000		$ 15,405	$ 6,230	$ -	$ 21,635	Vendor Pricing
Pump	1	EA	$ 500	$ 500		$ 514	$ 623	$ -	$ 1,137	Vendor Pricing
Miscellaneous Electrical	1	LS	$ 500	$ 500		$ 514	$ 623	$ -	$ 1,137	RS Means 2012
Venting Kit	1	EA	$ 450	$ 650		$ 462	$ 810	$ -	$ 1,272	RS Means 2012
Miscellaneous Piping and Valves	1	LS	$ 500	$ 500		$ 514	$ 623	$ -	$ 1,137	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 27,033	Subtotal
$ 6,758	25% Contingency
$ 33,791	**Total**

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-7: Replace Unit Heaters with 2-Stage Infrared Heaters

EXISTING CONDITIONS		
Existing Unit Heater Total Natual Gas Usage	5,733	Therms
Existing Infrared Equipment Usage	389,810	Mbtu/yr
Proposed Heating Gas Usage	4,586	Therms
Total energy savings	1,147	Therms
Total cost savings	$1,402	

Assumptions

	$ 1.22	$/Therm
1	80%	Existing Unit heater operating efficiency
2	85%	Existing Unit Distribution Effectiveness
3	85%	Proposed infrared heater operational efficiency
4	100%	Proposed Unit Distribution Effectiveness
5	$2,250	New 2-Stage Infrared Heater
6	10	Number of existing unit heaters to be replaced

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-7: Replace Unit Heaters with 2-Stage Infrared Heaters - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Two-Stage Ceiling Mounted Radiant Heater	10	EA	$ 2,500	$ 1,500	INC	$ 25,675	$ 18,690	INC	$ 44,365	Grainger.com
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 44,365	Subtotal
$ 11,091	25% Contingency
$ 55,456	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-8: Replace Electric Kitchen Equipment with Natural Gas Equipment

ECM Description Summary

A commercial cafeteria kitchen typically contains large equipment such as warming/convection ovens, and fryers. This equipment consumes large ammounts of electrical energy, and wiith the cost of electricity versus natural gas, it is worthwhile to consider replacing electric equipment with nagtural gas equipment. The assumption of this calculation is that the operating hours and electrical power consumption of the existing electrical equipment are replaced with newer, more efficient equipment using natural gas. The savings are compared to the cost of new gas kitchen equipment; the connection cost (if any) to the natural gas utility and piping in the building is not included.

Existing Fuel Electric
Proposed Fuel Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 0.12	/ kWh	from utility bill analysis
Proposed Fuel Cost	$ 1.22	/ Therm	from utility bill analysis
Kitchen Equipment			
- Commercial Warming Ovens	60.0	kW	Based on equipment nameplate data (4x units, 15 kW each)
- Total Equipment kW	60.0	**kW**	
Kitchen Annual Operating Hours	1,140	hours	6 hours per day x 5 days per week x 38 weeks per year
Baseline Equipment Efficiency	100%		
Baseline Annual Electric Use	68,400	**kWh**	
Baseline Annual Electric Cost	$ 8,345		
Proposed Equipment Efficiency	100%		
Proposed Fuel Use	2,334	**Therms**	Baseline Electric Use x 3,412 BTU/kWh / 100,000 BTU/Therm
Proposed Fuel Cost	$ 2,854		
Annual Savings	$ 5,491		
Natural Gas Equipment Project Cost	$ 100,652		
Simple Payback	18.3	Years	

*Note to engineer: Link savings back to summary sheet in appropriate column.

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Building 4

ECM-8: Replace Electric Kitchen Equipment with Natural Gas Equipment - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Electric Equipment Replacement	1	LS	$ -	$ 500		$ -	$ 623	$ -	$ 623	RS Means 2012
(4) Natural Gas-Fired Commercial Warming Ovens	4	EA	$ 12,000	$ 5,000		$ 49,296	$ 24,920	$ -	$ 74,216	Vendor Estimate
Miscellaneous NG Piping	1	LS	$ 2,500	$ 2,500		$ 2,568	$ 3,115	$ -	$ 5,683	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 80,522	Subtotal
$ 20,130	25% Contingency
$ 100,652	**Total**

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Building 4

ECM-9: Computer Network Controller Savings Calculations

Notes:

1. This ECM calculates the saving associated with the installation of a centralized computer management software installed on the client server that will cause the computers to hibernate and sleep during times of low or no usage.
2. Energy savings per computer are based on manuafactures historical information from previous installations
3. There are approximately 72 computers used in this building

Background Data **Average Consumption and Savings Figures**	**kWh**
Average Total Consumption per PC per Year	500-700
Average Energy and Cost Waste per PC per Year	350-450
Average savings per PC	70
Average savings per IMac	50

Number of PCs	72
Number of IMac's	0
Return on Investment Analysis	
	kWh
Annual Energy Savings	5,040
Total network controller software package cost	$1,776

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-9: Computer Network Controller Savings Calculations - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Computer Network Controller Software	1	LS	$ 625	$ 625	$ -	$ 642	$ 779	$ -	$ 1,421	Vendor Estimation
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 1,421	Subtotal
$ 355	25% Contingency
$ 1,776	**Total**

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Building 4

ECM-10: Replace urinals and flush valves with low flow

Description: This ECM evaluates the water savings associated with replacing/ upgrading urinals with 0.125 GPF urinals and or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Urinals in Building to be replaced	6	
Average Flushes / Urinal (per Day)	15	Based on # of occupants
Average Gallons / Flush	1.5	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	6	
Proposed Gallons / Flush	0.125	Gal
Proposed Material Cost of new urinal & valve	$1,200	RS Means 2012
Proposed Installation Cost of new urinal & valve	$1,000	RS Means 2012
Total cost of new urinals & valves		

SAVINGS		
Current Urinal Water Use	49.28	kGal / year
Proposed Urinal Water Use	4.11	kGal / year
Water Savings	45.17	kGal / year
Cost Savings	$407	/ year

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
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Building 4

ECM-10: Replace toilets and flush valves with low flow

Description: This ECM evaluates the water savings associated with repalcing/ upgrading toilets to 1.28 GPF fixtures and/or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Toilets in Building	7	
Average Flushes / Toilet (per Day)	15	Based on # of occupants
Average Gallons / Flush	2.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	7	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	95.81	kGal / year
Proposed Toilet Water Use	49.06	kGal / year
Water Savings	46.76	kGal / year
Cost Savings	$421	/ year

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

ECM-10: Replace faucets with low flow

Description; This ECM evaluates the water savings resulting from replacing/ upgrading faucets to 0.5 gallon per minute flow

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$9.00	$ / kGal
Faucets in Building	2	
Average Uses / Faucet (per day)	15	Based on # of occupants
Average Time of Use	10.0	seconds
Average Flowrate	2.0	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	2	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	$ 1.22	/Therm
Number of Faucets	2	
Hours per Day of Usage	0.5	hrs
Days per Year of Facility Usage	182	days
Average Flowrate	2.0	gpm
Proposed Flowrate	0.5	gpm
Heat Content of Water	8.33	Btu/gal/F
Temperature Difference (Intake and Output)	50	F
Water Heating Equipment Efficiency	80%	
Conversion Factor	100,000	Btu/Therm
SAVINGS		
Current Faucet Water Use	1.82	kGal / year
Proposed Faucet Water Use	0.46	kGal / year
Water Savings	1.37	kGal / year
Heating Savings	85	Therms
Cost Savings	$117	/ year

Savings calculation formulas are taken from NJ Protocols document for Faucet

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 4

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Replace Plumbing Fixtures with Low-Flow Equivalents - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Low-Flow Urinal	6	EA	$ 1,200	$ 1,000	$ -	$ 7,394	$ 7,476	$ -	$ 14,870	Vendor Estimate
Low-Flow Toilet	7	EA	$ 1,400	$ 1,000	$ -	$ 10,065	$ 8,722	$ -	$ 18,787	Vendor Estimate
Low-Flow Faucet	2	EA	$ 20	$ 20	$ -	$ 41	$ 50	$ -	$ 91	Vendor Estimate
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 33,748	Subtotal
$ 8,437	25% Contingency
$ 42,185	**Total**

Morris County Vocational Technical School District - LGEA
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Building 4

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	79,925
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$95,001	$73,047
Existing Usage (from utility)	777,920	59,725
Proposed Savings	311,295	21,713
Existing Total MMBtus	8,628	
Proposed Savings MMBtus	3,234	
% Energy Reduction	**37.5%**	
Proposed Annual Savings	$62,532	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$34,242	$27,141	$61,384
Incentive #3	$34,242	$27,141	$61,384
Total All Incentives	**$68,485**	**$54,282**	**$127,767**

Total Project Cost	$3,940,069

		Allowable Incentive
% Incentives #1 of Utility Cost*	3.0%	$5,000
% Incentives #2 of Project Cost**	1.6%	$61,384
% Incentives #3 of Project Cost**	1.6%	$61,384
Total Eligible Incentives***	**$127,767**	
Project Cost w/ Incentives	$3,812,302	

Project Payback (years)	
w/o Incentives	w/ Incentives
63.0	61.0

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 4

CHA Project No. 28950

ECM-L1 Lighting Replacements

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
4LED	Hallways	54	2B 34 R F 2 (u) (MAG)	FU2EE	72	3.9	SW	2200	8,865	54	2T 25 R LED	2RTLED	25	1.4	SW	2,200	3,078	5,787	2.5	$ 671.55	$ 10,935.00	$2,700	16.3	12.3
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
146LED	401 Auto Class	15	High Bay MH 400	MH400/1	458	6.9	SW	3200	21,984	15	BAYLED78W	BAYLED78W	93	1.4	SW	3,200	4,464	17,520	5.5	$ 1,952.39	$ 12,662.93	$1,500	6.5	5.7
54LED	401 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	SW	3,200	768	614	0.2	$ 68.47	$ 1,690.20	$300	24.7	20.3
54LED	401 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	401 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	SW	3,200	128	102	0.0	$ 11.41	$ 281.70	$50	24.7	20.3
54LED	401 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
54LED	Nurse Exam Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3000	864	4	STLED4	STLED4	40	0.2	SW	3,000	480	384	0.1	$ 43.08	$ 1,126.80	$200	26.2	21.5
117	Nurse Exam Room	2	CF 23	CFS23/1	23	0.0	SW	3000	138	2	CF 23	CFS23/1	23	0.0	SW	3,000	138	-	0.0	$ -	$ -	$0		#DIV/0!
247LED	Nurse Office	4	T 40 R F 3 (MAG)	F43SE	136	0.5	SW	3000	1,632	4	T 38 R LED	RTLED38	38	0.2	SW	3,000	456	1,176	0.4	$ 131.95	$ 945.00	$200	7.2	5.6
146LED	402A Classroom	8	High Bay MH 400	MH400/1	458	3.7	SW	3200	11,725	8	BAYLED78W	BAYLED78W	93	0.7	SW	3,200	2,381	9,344	2.9	$ 1,041.27	$ 6,753.56	$800	6.5	5.7
54LED	402A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
54LED	402 Auto Class	15	B 34 C F 2 (MAG)	F42EE	72	1.1	SW	3200	3,456	15	STLED4	STLED4	40	0.6	SW	3,200	1,920	1,536	0.5	$ 171.17	$ 4,225.50	$750	24.7	20.3
54LED	402 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	SW	3,200	768	614	0.2	$ 68.47	$ 1,690.20	$300	24.7	20.3
54LED	402 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	402 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	SW	3,200	128	102	0.0	$ 11.41	$ 281.70	$50	24.7	20.3
54LED	402 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
54LED	Boiler Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	SW	1,000	200	160	0.2	$ 21.86	$ 1,408.50	$250	64.4	53.0
54LED	Electrical Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	SW	1,000	200	160	0.2	$ 21.86	$ 1,408.50	$250	64.4	53.0
54LED	Phone Room	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	Storage	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	SW	1,000	200	160	0.2	$ 21.86	$ 1,408.50	$250	64.4	53.0
146LED	403 Class	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,053	13	BAYLED78W	BAYLED78W	93	1.2	SW	3,200	3,869	15,184	4.7	$ 1,692.07	$ 10,974.54	$1,300	6.5	5.7
54LED	403 Class Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
71	403 Paint Storage	2	I 60	I60/1	60	0.1	SW	1000	120	2	CF 26	CFQ26/1-L	27	0.1	SW	1,000	54	66	0.1	$ 9.02	$ 13.50	$0	1.5	1.5
54LED	403 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	403 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	403 Tool Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 34.23	$ 845.10	$150	24.7	20.3
54LED	403A Class	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,765	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,229	0.4	$ 136.93	$ 3,380.40	$600	24.7	20.3
54LED	Computer Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
54LED	407 Media/Library	42	B 34 C F 2 (MAG)	F42EE	72	3.0	SW	3200	9,677	42	STLED4	STLED4	40	1.7	SW	3,200	5,376	4,301	1.3	$ 479.27	$ 11,831.40	$2,100	24.7	20.3
54LED	407 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	407 Faculty Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	407 Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3000	432	2	STLED4	STLED4	40	0.1	SW	3,000	240	192	0.1	$ 21.54	$ 563.40	$100	26.2	21.5
71	407 Office Restroom	1	I 60	I60/1	60	0.1	SW	1000	60	1	CF 26	CFQ26/1-L	27	0.0	SW	1,000	27	33	0.0	$ 4.51	$ 6.75	$0	1.5	1.5
54LED	407 Conference Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,152	5	STLED4	STLED4	40	0.2	SW	3,200	640	512	0.2	$ 57.06	$ 1,408.50	$250	24.7	20.3
146LED	404 Auto Body	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,053	13	BAYLED78W	BAYLED78W	93	1.2	SW	3,200	3,869	15,184	4.7	$ 1,692.07	$ 10,974.54	$1,300	6.5	5.7
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 34.23	$ 845.10	$150	24.7	20.3
71	404 Auto Body	2	I 60	I60/1	60	0.1	SW	3200	384	2	CF 26	CFQ26/1-L	27	0.1	SW	3,200	173	211	0.1	$ 23.54	$ 13.50	$0	0.6	0.6
54LED	404 Auto Body	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	SW	3,200	128	102	0.0	$ 11.41	$ 281.70	$50	24.7	20.3
54LED	404 Auto Body	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	SW	3,200	384	307	0.1	$ 34.23	$ 845.10	$150	24.7	20.3
54LED	404 Auto Body	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,765	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,229	0.4	$ 136.93	$ 3,380.40	$600	24.7	20.3
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
146LED	405 Classroom	18	High Bay MH 400	MH400/1	458	8.2	SW	3200	26,381	18	BAYLED78W	BAYLED78W	93	1.7	SW	3,200	5,357	21,024	6.6	$ 2,342.86	$ 15,195.52	$1,800	6.5	5.7
54LED	405 Storage/Restroom	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
71	405 Storage/Restroom	1	I 60	I60/1	60	0.1	SW	1000	60	1	CF 26	CFQ26/1-L	27	0.0	SW	1,000	27	33	0.0	$ 4.51	$ 6.75	$0	1.5	1.5
54LED	405 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	405 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	405 Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	405 Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
54LED	406 Classroom	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	SW	3,200	768	614	0.2	$ 68.47	$ 1,690.20	$300	24.7	20.3
54LED	406 Classroom	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	SW	3,200	2,048	1,638	0.5	$ 182.58	$ 4,507.20	$800	24.7	20.3
54LED	406 Classroom	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	SW	3,200	2,048	1,638	0.5	$ 182.58	$ 4,507.20	$800	24.7	20.3
54LED	406 Classroom	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	SW	3,200	2,048	1,638	0.5	$ 182.58	$ 4,507.20	$800	24.7	20.3
54LED	406 Boys Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	406 Girls Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	406 Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	406 Storage	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	STLED4	STLED4	40	0.2	SW	1,000	160	128	0.1	$ 17.48	$ 1,126.80	$200	64.4	53.0
146LED	408 Welding Class	15	High Bay MH 400	MH400/1	458	6.9	SW	3200	21,984	15	BAYLED78W	BAYLED78W	93	1.4	SW	3,200	4,464	17,520	5.5	$ 1,952.39	$ 12,662.93	$1,500	6.5	5.7
54LED	408 Welding Booths	30	B 34 C F 2 (MAG)	F42EE	72	2.2	SW	3200	6,912	30	STLED4	STLED4	40	1.2	SW	3,200	3,840	3,072	1.0	$ 342.34	$ 8,451.00	$1,500	24.7	20.3
54LED	408 Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
54LED	408 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	409A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
54LED	409A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	SW	3,200	1,024	819	0.3	$ 91.29	$ 2,253.60	$400	24.7	20.3
218LED	410 Chemistry	30	W 32 P F 3 (ELE)	F43ILL/2	90	2.7	SW	3200	8,640	30	STLED4	STLED4	40	1.2	SW	3,200	3,840	4,800	1.5	$ 534.90	$ 8,451.00	$1,500	15.8	13.0
55LED	411 Special Education	7	2T 17 R F 3 (ELE)	F23ILL	47	0.3	SW	3200	1,053	7	2T 25 R LED	2RTLED	25	0.2	SW	3,200	560	493	0.2	$ 54.92	$ 1,417.50	$350	25.8	19.4
247LED	421 Faculty Lounge	9	T 40 R F 3 (MAG)	F43SE	136	1.2	SW	3000	3,672	9	T 38 R LED	RTLED38	38	0.3	SW	3,000	1,026	2,646	0.9	$ 296.88	$ 2,126.25	$450	7.2	5.6
218LED	412 Biology	11	W 32 P F 3 (ELE)	F43ILL/2	90	1.0	SW	3200	3,168	11	STLED4	STLED4	40	0.4	SW	3,200	1,408	1,760	0.6	$ 196.13	$ 3,098.70	$550	15.8	13.0
218LED	412A Biology	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	SW	3200	3,456	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,920	0.6	$ 213.96	$ 3,380.40	$600	15.8	13.0
218LED	412B	12	W 32 P F 3 (ELE)	F43ILL/2	90	1.1	SW	3200	3,456	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,920	0.6	$ 213.96	$ 3,380.40	$600	15.8	13.0
54LED	413 Classroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
247LED	414 Classroom	15	T 40 R F 3 (MAG)	F43SE	136	2.0	SW	3200	6,528	15	T 38 R LED	RTLED38	38	0.6	SW	3,200	1,824	4,704	1.5	$ 524.20	$ 3,543.75	$750	6.8	5.3
247LED	414 Classroom	10	T 40 R F 3 (MAG)	F43SE	136	1.4	SW	3200	4,352	10	T 38 R LED	RTLED38	38	0.4	SW	3,200	1,216	3,136	1.0	$ 349.47	$ 2,362.50	$500	6.8	5.3
247LED	414 Classroom	13	T 40 R F 3 (MAG)	F43SE	136	1.8	SW	3200	5,658	13	T 38 R LED	RTLED38	38	0.5	SW	3,200	1,581	4,077	1.3	$ 454.31	$ 3,071.25	$650	6.8	5.3
28	414 Boys Restroom	1	CR 32 C F 1	FC12/1	31	0.0	SW	1000	31	1	CR 32 C F 1	FC12/1	31	0.0	SW	1,000	31	-	0.0	$ -	$ -	$0		#DIV/0!
54LED	414A Computer Lab	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,765	12	STLED4	STLED4	40	0.5	SW	3,200	1,536	1,229	0.4	$ 136.93	$ 3,380.40	$600	24.7	20.3
54LED	414A Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
54LED	414A Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	Rear Hall Mens Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
218LED	417 Classroom	18	W 32 P F 3 (ELE)	F43ILL/2	90	1.6	SW	3200	5,184	18	STLED4	STLED4	40	0.7	SW	3,200	2,304	2,880	0.9	$ 320.94	$ 5,070.60	$900	15.8	13.0
54LED	417 Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	SW	1,000	80	64	0.1	$ 8.74	$ 563.40	$100	64.4	53.0
54LED	415 Culinary Arts	38	B 34 C F 2 (MAG)	F42EE	72	2.7	SW	3200	8,755	38	STLED4	STLED4	40	1.5	SW	3,200	4,864	3,891	1.2	$ 433.63	$ 10,704.60	$1,900	24.7	20.3
54LED	415 Pantry Room	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	SW	1,000	40	32	0.0	$ 4.37	$ 281.70	$50	64.4	53.0
247LED	415 Office	2	T 40 R F 3 (MAG)	F43SE	136	0.3	SW	3000	816	2	T 38 R LED	RTLED38	38	0.1	SW	3,000	228	588	0.2	$ 65.97	$ 472.50	$100	7.2	5.6
54LED	415 Dishwashing Room	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	SW	3,200	256	205	0.1	$ 22.82	$ 563.40	$100	24.7	20.3
54LED	415 Boys Locker/Restroom	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
54LED	415 Girls Locker/Restroom	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	SW	1,000	120	96	0.1	$ 13.11	$ 845.10	$150	64.4	53.0
247LED	Culinary Arts Cafeteria	16	T 40 R F 3 (MAG)	F43SE	136	2.2	SW	3200	6,963	16	T 38 R LED	RTLED38	38	0.6	SW	3,200	1,946	5,018	1.6	$ 559.15	$ 3,780.00	$800	6.8	5.3
218LED	418 Classroom	32	W 32 P F 3 (ELE)	F43ILL/2	90	2.9	SW	3200	9,216	32	STLED4	STLED4	40	1.3	SW	3,200	4,096	5,120	1.6	$ 570.56	$ 9,014.40	$1,600	15.8	13.0
254LED	Guidance Office	5	CFQ26/2	CFQ26/2	66	0.3	SW	3000	990	5	EVO35/10	EVO35/10	39	0.2	SW	3,000	585	405	0.1	$ 45.44	$ 2,193.75	$175	48.3	44.4
254LED	Guidance Office	2	CFQ26/2	CFQ26/2	66	0.1	SW	3000	396	2	EVO35/10	EVO35/10	39	0.1	SW	3,000	234	162	0.1	$ 18.18	$ 877.50	$70	48.3	44.4
254LED	Guidance Office	3	CFQ26/2	CFQ26/2	66	0.2	SW	3000	594	3	EVO35/10	EVO35/10	39	0.1	SW	3,000	351	243	0.1	$ 27.26	$ 1,316.25	$105	48.3	44.4
254LED	Guidance Office	3	CFQ26/2	CFQ26/2	66	0.2	SW	3000	594	3	EVO35/10	EVO35/10	39	0.1	SW	3,000	351	243	0.1	$ 27.26	$ 1,316.25	$105	48.3	44.4
254LED	Guidance Office	3	CFQ26/2	CFQ26/2	66	0.2	SW	3000	594	3	EVO35/10	EVO35/10	39	0.1	SW	3,000	351	243	0.1	$ 27.26	$ 1,316.25	$105	48.3	44.4
254LED	Guidance Office	4	CFQ26/2	CFQ26/2	66	0.3	SW	3000	792	4	EVO35/10	EVO35/10	39	0.2	SW	3,000	468	324	0.1	$ 36.35	$ 1,755.00	$140	48.3	44.4
117	Main Entrance	6	CF 23	CFS23/1	23	0.1	SW	2280	315	6	CF 23	CFS23/1	23	0.1	SW	2,280	315	-	0.0	$ -	$ -	$0		#DIV/0!
	Total	**746**				**91.1**			**275,838**	**746**			**4,133**	**32.9**				**97,438**	**178,400**	**58.2**	**$19,969**	**$247,262**	**$40,350**		
																		Demand Savings		**58.2**		**$2,129**			
																		kWh Savings			**178,400**	**$17,840**			
																		Total savings				**$19,969**		**12.4**	**10.4**

Morris County Vocational Technical School LGEA - Building 4
CHA Project No. 28950
ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	($/kWh) * (kW Saved)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
4LED	Hallways	54	2B 34 R F 2 (u) (MAG)	FU2EE	72	3.9	SW	2280	8,864.6	54	2B 34 R F 2 (u) (MAG)	FU2EE	72	3.9	NONE	2280	8,864.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843.2	8	B 34 C F 2 (MAG)	F42EE	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$53.64	$270.00	$35.00	5.0	4.4
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843.2	8	B 34 C F 2 (MAG)	F42EE	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$53.64	$270.00	$35.00	5.0	4.4
146LED	401 Auto Class	15	High Bay MH 400	MH400/1	458	6.9	SW	3200	21,984.0	15	High Bay MH 400	MH400/1	458	6.9	NONE	3200	21,984.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	401 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382.4	6	B 34 C F 2 (MAG)	F42EE	72	0.4	C-OCC	2240	967.7	414.7	0.0	$40.23	$270.00	$35.00	6.7	5.8
54LED	401 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	401 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230.4	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	230.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	401 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Nurse Exam Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3000	864.0	4	B 34 C F 2 (MAG)	F42EE	72	0.3	NONE	3000	864.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
117	Nurse Exam Room	2	CF 23	CFS23/1	23	0.0	SW	3000	138.0	2	CF 23	CFS23/1	23	0.0	NONE	3000	138.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
247LED	Nurse Office	4	T 40 R F 3 (MAG)	F43SE	136	0.5	SW	3000	1,632.0	4	T 40 R F 3 (MAG)	F43SE	136	0.5	C-OCC	1500	816.0	816.0	0.0	$79.15	$270.00	$35.00	3.4	3.0
146LED	402A Classroom	8	High Bay MH 400	MH400/1	458	3.7	SW	3200	11,724.8	8	High Bay MH 400	MH400/1	458	3.7	C-OCC	2240	8,207.4	3,517.4	0.0	$341.19	$270.00	$35.00	0.8	0.7
54LED	402A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843.2	8	B 34 C F 2 (MAG)	F42EE	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$53.64	$270.00	$35.00	5.0	4.4
54LED	402 Auto Class	15	B 34 C F 2 (MAG)	F42EE	72	1.1	SW	3200	3,456.0	15	B 34 C F 2 (MAG)	F42EE	72	1.1	NONE	3200	3,456.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	402 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382.4	6	B 34 C F 2 (MAG)	F42EE	72	0.4	C-OCC	2240	967.7	414.7	0.0	$40.23	$270.00	$35.00	6.7	5.8
54LED	402 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	402 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230.4	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	230.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	402 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Boiler Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360.0	5	B 34 C F 2 (MAG)	F42EE	72	0.4	NONE	1000	360.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Electrical Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360.0	5	B 34 C F 2 (MAG)	F42EE	72	0.4	NONE	1000	360.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Phone Room	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Storage	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360.0	5	B 34 C F 2 (MAG)	F42EE	72	0.4	NONE	1000	360.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
146LED	403 Class	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,052.8	13	High Bay MH 400	MH400/1	458	6.0	C-OCC	2240	13,337.0	5,715.8	0.0	$554.44	$270.00	$35.00	0.5	0.4
54LED	403 Class Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
71	403 Paint Storage	2	I 60	I60/1	60	0.1	SW	1000	120.0	2	I 60	I60/1	60	0.1	NONE	1000	120.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	403 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	403 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	403 Tool Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	403A Class	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,764.8	12	B 34 C F 2 (MAG)	F42EE	72	0.9	C-OCC	2240	1,935.4	829.4	0.0	$80.46	$270.00	$35.00	3.4	2.9
54LED	Computer Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	407 Media/Library	42	B 34 C F 2 (MAG)	F42EE	72	3.0	SW	3200	9,676.8	42	B 34 C F 2 (MAG)	F42EE	72	3.0	C-OCC	2240	6,773.8	2,903.0	0.0	$281.59	$270.00	$35.00	1.0	0.8
54LED	407 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	407 Faculty Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	700	50.4	21.6	0.0	$2.10	$270.00	$35.00	128.9	112.2
54LED	407 Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3000	432.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	C-OCC	1500	216.0	216.0	0.0	$20.95	$270.00	$35.00	12.9	11.2
71	407 Office Restroom	1	I 60	I60/1	60	0.1	SW	1000	60.0	1	I 60	I60/1	60	0.1	C-OCC	700	42.0	18.0	0.0	$1.75	$270.00	$35.00	154.6	134.6
54LED	407 Conference Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,152.0	5	B 34 C F 2 (MAG)	F42EE	72	0.4	C-OCC	2240	806.4	345.6	0.0	$33.52	$270.00	$35.00	8.1	7.0
146LED	404 Auto Body	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,052.8	13	High Bay MH 400	MH400/1	458	6.0	NONE	3200	19,052.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
71	404 Auto Body	2	I 60	I60/1	60	0.1	SW	3200	384.0	2	I 60	I60/1	60	0.1	NONE	3200	384.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	404 Auto Body	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230.4	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	230.4	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	404 Auto Body	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	460.8	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	3200	460.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691.2	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	3200	691.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	404 Auto Body	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,764.8	12	B 34 C F 2 (MAG)	F42EE	72	0.9	NONE	3200	2,764.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843.2	8	B 34 C F 2 (MAG)	F42EE	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$53.64	$270.00	$35.00	5.0	4.4
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843.2	8	B 34 C F 2 (MAG)	F42EE	72	0.6	C-OCC	2240	1,290.2	553.0	0.0	$53.64	$270.00	$35.00	5.0	4.4
146LED	405 Classroom	18	High Bay MH 400	MH400/1	458	8.2	SW	3200	26,380.8	18	High Bay MH 400	MH400/1	458	8.2	NONE	3200	26,380.8	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405 Storage/Restroom	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
71	405 Storage/Restroom	1	I 60	I60/1	60	0.1	SW	1000	60.0	1	I 60	I60/1	60	0.1	NONE	1000	60.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72.0	1	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	72.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405 Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	B 34 C F 2 (MAG)	F42EE	72	0.1	NONE	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	405 Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216.0	3	B 34 C F 2 (MAG)	F42EE	72	0.2	NONE	1000	216.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
54LED	406 Classroom	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382.4	6	B 34 C F 2 (MAG)	F42EE	72	0.4	C-OCC	2240	967.7	414.7	0.0	$40.23	$270.00	$35.00	6.7	5.8
54LED	406 Classroom	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686.4	16	B 34 C F 2 (MAG)	F42EE	72	1.2	C-OCC	2240	2,580.5	1,105.9	0.0	$107.27	$270.00	$35.00	2.5	2.2

Morris County Vocational Technical School LGEA - Building 4
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
4LED	Hallways	54	2B 34 R F 2 (u) (MAG)	FU2EE	72	3.9	SW	2280	8,865	54	2T 25 R LED	2RTLED	25	1.4	NONE	2,280	3,078	5,787	2.5	$ 654.19	$ 10,935.00	$ 2,700	16.7	12.6
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,126	0.3	$ 118.63	$ 2,523.60	$ 435	21.3	17.6
54LED	401A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,126	0.3	$ 118.63	$ 2,523.60	$ 435	21.3	17.6
146LED	401 Auto Class	15	High Bay MH 400	MH400/1	458	6.9	SW	3200	21,984	15	BAYLED78W	BAYLED78W	93	1.4	NONE	3,200	4,464	17,520	5.5	$ 1,899.83	$ 12,662.93	$ 1,500	6.7	5.9
54LED	401 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	C-OCC	2,240	538	845	0.2	$ 88.97	$ 1,960.20	$ 335	22.0	18.3
54LED	401 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	NONE	1,000	80	64	0.1	$ 8.55	$ 563.40	$ 100	65.9	54.2
54LED	401 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	NONE	3,200	128	102	0.0	$ 11.10	$ 281.70	$ 50	25.4	20.9
54LED	401 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 22.21	$ 563.40	$ 100	25.4	20.9
54LED	Nurse Exam Room	4	B 34 C F 2 (MAG)	F42EE	72	0.3	SW	3000	864	4	STLED4	STLED4	40	0.2	NONE	3,000	480	384	0.1	$ 41.93	$ 1,126.80	$ 200	26.9	22.1
117	Nurse Exam Room	2	CF 23	CFS23/1	23	0.0	SW	3000	138	2	CF 23	CFS23/1	23	0.0	NONE	3,000	138	-	0.0	$ -	$ -	$ -	-	
247LED	Nurse Office	4	T 40 R F 3 (MAG)	F43SE	136	0.5	SW	3000	1,632	4	T 38 R LED	RTLED38	38	0.2	C-OCC	1,500	228	1,404	0.4	$ 150.54	$ 1,215.00	$ 235	8.1	6.5
146LED	402A Classroom	8	High Bay MH 400	MH400/1	458	3.7	SW	3200	11,725	8	BAYLED78W	BAYLED78W	93	0.7	C-OCC	2,240	1,667	10,058	2.9	$ 1,082.52	$ 7,023.56	$ 835	6.5	5.7
54LED	402A Classroom	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,126	0.3	$ 118.63	$ 2,523.60	$ 435	21.3	17.6
54LED	402 Auto Class	15	B 34 C F 2 (MAG)	F42EE	72	1.1	SW	3200	3,456	15	STLED4	STLED4	40	0.6	NONE	3,200	1,920	1,536	0.5	$ 166.56	$ 4,225.50	$ 750	25.4	20.9
54LED	402 Auto Class Office/Tool Storage	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	C-OCC	2,240	538	845	0.2	$ 88.97	$ 1,960.20	$ 335	22.0	18.3
54LED	402 Auto Class Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	NONE	1,000	80	64	0.1	$ 8.55	$ 563.40	$ 100	65.9	54.2
54LED	402 Auto Class Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	NONE	3,200	128	102	0.0	$ 11.10	$ 281.70	$ 50	25.4	20.9
54LED	402 Auto Class Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 22.21	$ 563.40	$ 100	25.4	20.9
54LED	Boiler Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	NONE	1,000	200	160	0.2	$ 21.38	$ 1,408.50	$ 250	65.9	54.2
54LED	Electrical Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	NONE	1,000	200	160	0.2	$ 21.38	$ 1,408.50	$ 250	65.9	54.2
54LED	Phone Room	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 4.28	$ 281.70	$ 50	65.9	54.2
54LED	Storage	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	1000	360	5	STLED4	STLED4	40	0.2	NONE	1,000	200	160	0.2	$ 21.38	$ 1,408.50	$ 250	65.9	54.2
146LED	403 Class	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,053	13	BAYLED78W	BAYLED78W	93	1.2	C-OCC	2,240	2,708	16,345	4.7	$ 1,759.10	$ 11,244.54	$ 1,335	6.4	5.6
54LED	403 Class Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 12.83	$ 845.10	$ 150	65.9	54.2
71	403 Paint Storage	1	I60/1	I60/1	60	0.1	SW	1000	120	2	CF 26	CFQ26/1-L	27	0.1	NONE	1,000	54	66	0.1	$ 8.82	$ 13.50	$ -	1.5	1.5
54LED	403 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 4.28	$ 281.70	$ 50	65.9	54.2
54LED	403 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	NONE	1,000	80	64	0.1	$ 8.55	$ 563.40	$ 100	65.9	54.2
54LED	403 Tool Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 33.31	$ 845.10	$ 150	25.4	20.9
54LED	403A Class	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,765	12	STLED4	STLED4	40	0.5	C-OCC	2,240	1,075	1,690	0.4	$ 177.95	$ 3,650.40	$ 635	20.5	16.9
54LED	Computer Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 4.28	$ 281.70	$ 50	65.9	54.2
54LED	Storage	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 12.83	$ 845.10	$ 150	65.9	54.2
54LED	407 Media/Library	42	B 34 C F 2 (MAG)	F42EE	72	3.0	SW	3200	9,677	42	STLED4	STLED4	40	1.7	C-OCC	2,240	3,763	5,914	1.3	$ 622.81	$ 12,101.40	$ 2,135	19.4	16.0
54LED	407 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 4.28	$ 281.70	$ 50	65.9	54.2
54LED	407 Faculty Restroom	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	C-OCC	700	28	44	0.0	$ 5.44	$ 551.70	$ 85	101.4	85.8
54LED	407 Office	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3000	432	2	STLED4	STLED4	40	0.1	C-OCC	1,500	120	312	0.1	$ 32.61	$ 833.40	$ 135	25.6	21.4
71	407 Office Restroom	1	I 60	I60/1	60	0.1	SW	1000	60	1	CF 26	CFQ26/1-L	27	0.0	C-OCC	700	19	41	0.0	$ 5.19	$ 276.75	$ 35	53.3	46.5
54LED	407 Conference Room	5	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,152	5	STLED4	STLED4	40	0.2	C-OCC	2,240	448	704	0.2	$ 74.14	$ 1,678.50	$ 285	22.6	18.8
146LED	404 Auto Body	13	High Bay MH 400	MH400/1	458	6.0	SW	3200	19,053	13	BAYLED78W	BAYLED78W	93	1.2	NONE	3,200	3,869	15,184	4.7	$ 1,646.52	$ 10,974.54	$ 1,300	6.7	5.9
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 33.31	$ 845.10	$ 150	25.4	20.9
71	404 Auto Body	2	I 60	I60/1	60	0.1	SW	3200	384	2	CF 26	CFQ26/1-L	27	0.1	NONE	3,200	173	211	0.1	$ 22.90	$ 13.50	$ -	0.6	0.6
54LED	404 Auto Body	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	230	1	STLED4	STLED4	40	0.0	NONE	3,200	128	102	0.0	$ 11.10	$ 281.70	$ 50	25.4	20.9
54LED	404 Auto Body	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	3200	461	2	STLED4	STLED4	40	0.1	NONE	3,200	256	205	0.1	$ 22.21	$ 563.40	$ 100	25.4	20.9
54LED	404 Auto Body	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	3200	691	3	STLED4	STLED4	40	0.1	NONE	3,200	384	307	0.1	$ 33.31	$ 845.10	$ 150	25.4	20.9
54LED	404 Auto Body	12	B 34 C F 2 (MAG)	F42EE	72	0.9	SW	3200	2,765	12	STLED4	STLED4	40	0.5	NONE	3,200	1,536	1,229	0.4	$ 133.25	$ 3,380.40	$ 600	25.4	20.9
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,126	0.3	$ 118.63	$ 2,523.60	$ 435	21.3	17.6
54LED	405a	8	B 34 C F 2 (MAG)	F42EE	72	0.6	SW	3200	1,843	8	STLED4	STLED4	40	0.3	C-OCC	2,240	717	1,126	0.3	$ 118.63	$ 2,523.60	$ 435	21.3	17.6
146LED	405 Classroom	18	High Bay MH 400	MH400/1	458	8.2	SW	3200	26,381	18	BAYLED78W	BAYLED78W	93	1.7	NONE	3,200	5,357	21,024	6.6	$ 2,279.79	$ 15,195.52	$ 1,800	6.7	5.9
54LED	405 Storage/Restroom	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 12.83	$ 845.10	$ 150	65.9	54.2
71	405 Storage/Restroom	1	I 60	I60/1	60	0.1	SW	1000	60	1	CF 26	CFQ26/1-L	27	0.0	NONE	1,000	27	33	0.0	$ 4.41	$ 6.75	$ -	1.5	1.5
54LED	405 Locker/Restroom	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	NONE	1,000	80	64	0.1	$ 8.55	$ 563.40	$ 100	65.9	54.2
54LED	405 Storage	1	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	72	1	STLED4	STLED4	40	0.0	NONE	1,000	40	32	0.0	$ 4.28	$ 281.70	$ 50	65.9	54.2
54LED	405 Tool Storage	2	B 34 C F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	STLED4	STLED4	40	0.1	NONE	1,000	80	64	0.1	$ 8.55	$ 563.40	$ 100	65.9	54.2
54LED	405 Mezzanine	3	B 34 C F 2 (MAG)	F42EE	72	0.2	SW	1000	216	3	STLED4	STLED4	40	0.1	NONE	1,000	120	96	0.1	$ 12.83	$ 845.10	$ 150	65.9	54.2
54LED	406 Classroom	6	B 34 C F 2 (MAG)	F42EE	72	0.4	SW	3200	1,382	6	STLED4	STLED4	40	0.2	C-OCC	2,240	538	845	0.2	$ 88.97	$ 1,960.20	$ 335	22.0	18.3
54LED	406 Classroom	16	B 34 C F 2 (MAG)	F42EE	72	1.2	SW	3200	3,686	16	STLED4	STLED4	40	0.6	C-OCC	2,240	1,434	2,253	0.5	$ 237.26	$ 4,777.20	$ 835	20.1	16.6

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

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COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

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Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

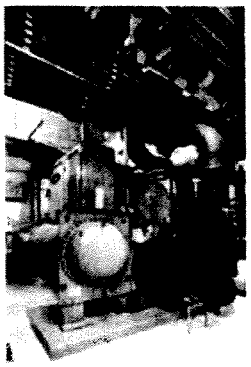
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

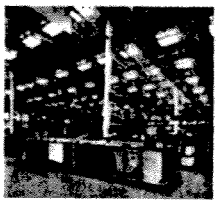
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

Home | Residential | Commercial & Industrial | Renewable Energy
About Us | Press Room | Library | FAQs | Calendar | Newsletters | Contact Us | Site

New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

APPENDIX E

Photovoltaic Analysis

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX F

Photos



1: Building Exterior



2: Existing Rooftop Units



3: Existing Domestic Hot Water Heater



4: Existing Kitchen Equipment



5: Existing Unit Heater



6. Existing Lighting

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

21

ENERGY STAR® Score[1]

Building 4

Primary Property Function: K-12 School
Gross Floor Area (ft²): 79,925
Built: 1984

For Year Ending: May 31, 2014
Date Generated: October 28, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address
Building 4
400 East Main Street
Denville, New Jersey 07834

Property Owner
Morris County Vocational School District
400 E Main Street
Denville, NJ 07834
(____)____-_____

Primary Contact
Mike Orlovsky
400 E Main Street
Denville, NJ 07834
(518)453-3980
mdewein@chacompanies.com

Property ID: 4195906

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
107.9 kBtu/ft²

Source EUI
182.7 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	5,972,532 (69%)
Electric - Grid (kBtu)	2,654,263 (31%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	82.5
National Median Source EUI (kBtu/ft²)	139.8
% Diff from National Median Source EUI	31%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	672

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp (if applicable)

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 5

400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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F Photos
G EPA Benchmarking Report

REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 5 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 5	400 E Main St, Denville, NJ 07834	5,900	1997

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
20,467	688	3,314	17.0

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

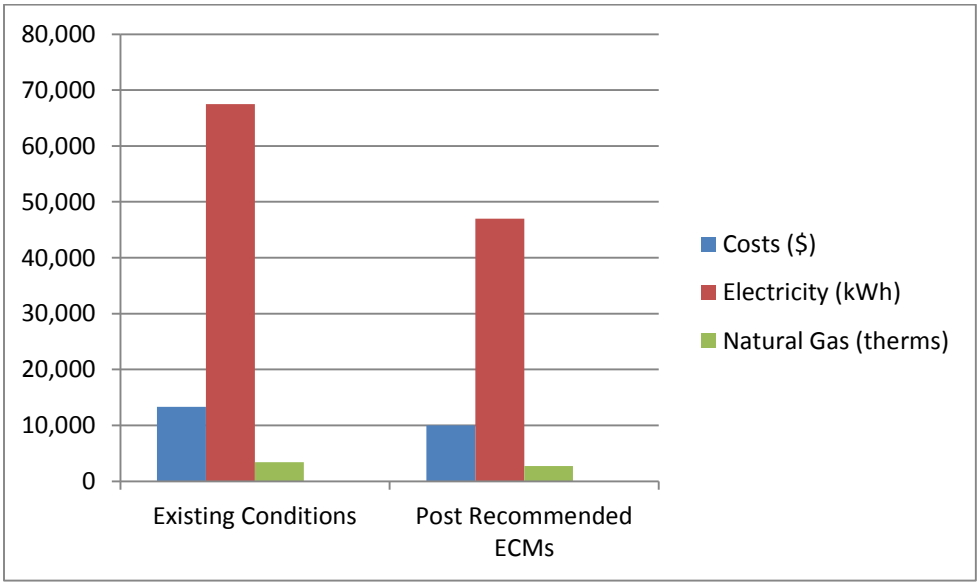
Summary of Energy Conservation Measures

ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Install Infrared Heaters to Replace Gas-Fired Unit Heaters	33,274	1,074	31.0	3,000	28.2	Y
L1	Lighting Replacements / Upgrades	30,402	2,240	13.6	4,200	11.7	Y
	Total**	63,676	3,314	19	7,200	17	
	Total (Recommended)	63,676	3,314	19	7,200	17	

* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	**Post Recommended ECMs**	**Percent Savings**
Costs ($)	13,331	10,017	25%
Electricity (kWh)	67,476	47,009	30%
Natural Gas (therms)	3,439	2,751	20%
Site EUI (kbtu/SF/Yr)	7.2	5.4	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 5
Gross Floor Area: 5,900
Number of Floors: 1
Year Built: 1997
Additions: None



Description of Spaces: Maintenance and storage areas
Description of Occupancy: This building is used for maintenance shop areas and storage spaces
Number of Computers: There are no computers in this building.
Building Usage: The building hours of operation are intermittent depending on when the maintenance staff needs to use the spaces.

Building Envelope

Construction Materials: Steel framed metal garage building
Façade: Metal siding
Roof: Steel framed pitched roof with metal roof decking and rolled asphalt exterior surface
Windows: There are no windows
Exterior Doors: There are (6) garage overhead doors and (7) entrance doors. Entrance doors are metal doors with foam insulation and overhead doors have insulated metal panels. The doors appear to be in good condition, and no ECMs for doors were included.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating: Heating for this building is provided by (6) natural gas fired unit heaters located in each garage bay. These units have a capacity of 50 MBH each and in fair condition. These heaters were originally installed during the 1997 construction.

An ECM has been included that evaluates the energy savings associated with replacing the existing unit heaters with more effective gas infrared heaters.

Cooling & Ventilation: This building is not air conditioned or ventilated mechanically.

Controls Systems

Each unit heater has a remote mounted non-programmable thermostat to control heating operation. The temperature is maintained at 68°F

Domestic Hot Water Systems

There is no domestic hot water system.

Kitchen Equipment

There is no kitchen.

Plug Load

This building has maintenance equipment which contributes to the plug load in the building. There are not any other significant electrical energy consuming devices.

Plumbing Systems

There are only janitor's mop sinks in this building that contribute to the domestic cold water consumption. These sinks are in good condition and would not benefit from replacement.

Lighting Systems

Lighting within this building consist of 400 watt high bay mercury vapor fixtures and T8 linear fluorescent fixtures. These fixtures are manually controlled by wall mounted switches. One ECM has been included to replace the existing lighting with new LED lighting fixtures.

3.0 UTILITIES

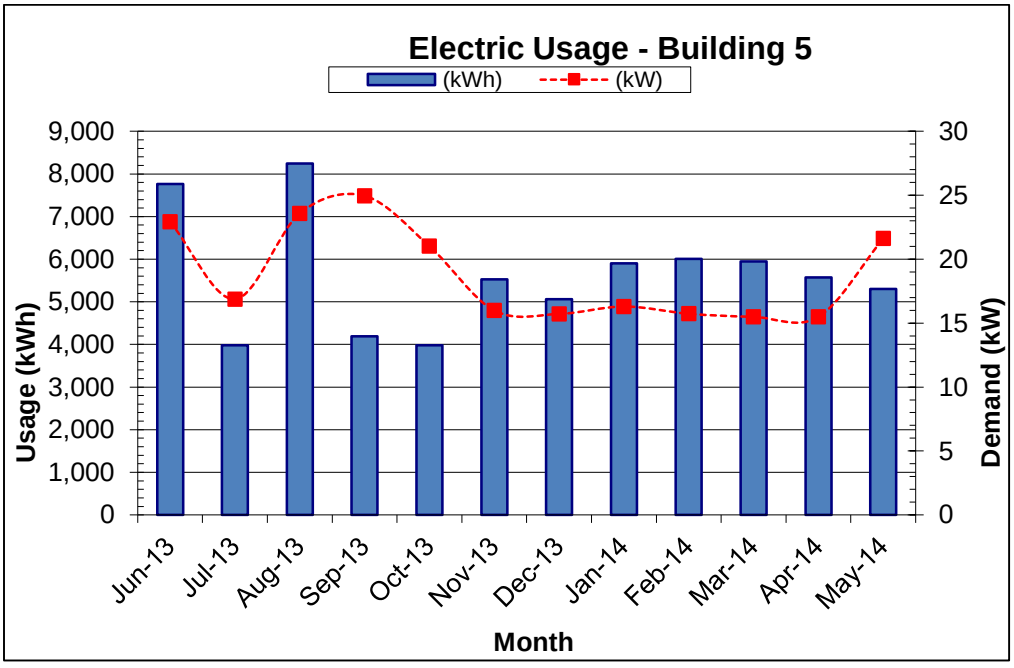
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	First Energy Solutions Corp.	New Jersey Natural Gas

For the 12-month period ending in December 2013, the utilities usages and costs for the building were as follows:

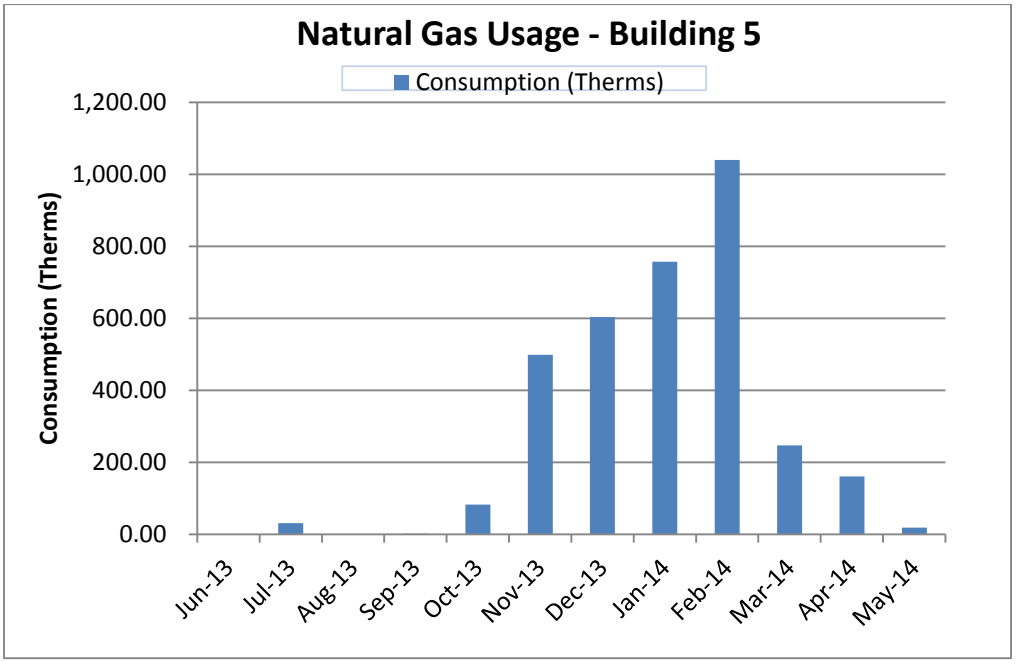
Electric		
Annual Consumption	67,476	kWh
Annual Cost	7,959	$
Blended Unit Rate	0.118	$/kWh
Supply Rate	0.091	$/kWh
Demand Rate	6.43	$/kW
Peak Demand	25.0	kW
Natural Gas		
Annual Consumption	3,439	Therms
Annual Cost	5,372	$
Unit Rate	1.562	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



The usage presented in the graph above appears to be typical of a maintenance garage/storage area. The peak consumption in the summer could potentially be a

result of the building being used more for building improvements being done while school is not in session.



The usage presented in the graph above appears to be typical of a maintenance garage/storage area. The peak consumption in the winter is the result of higher heating loads which requires the unit heaters to operate more often.

In addition, domestic water and sewer services are provided by the Township of Denville at $9.00/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.12	$0.13	N
Natural Gas	$/Therm	$1.56	$0.96	N
Fuel Oil	$/Gal	NA	$3.62	NA

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

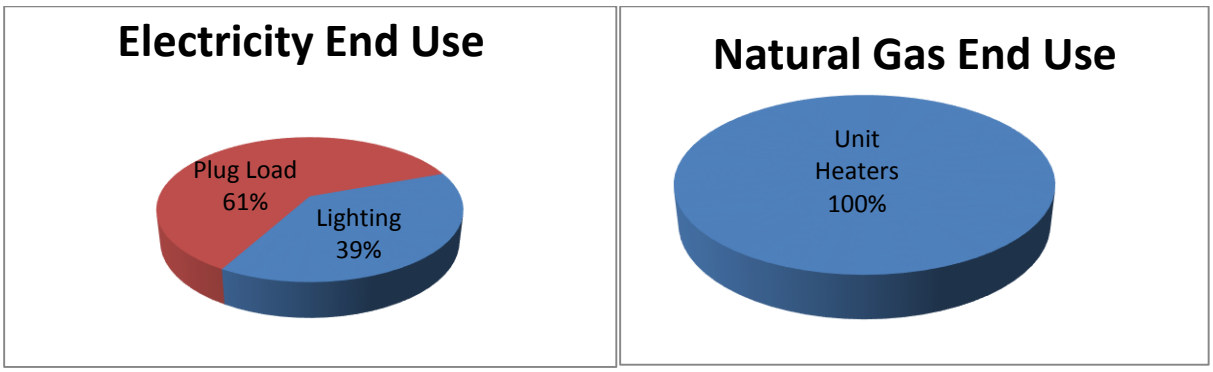
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

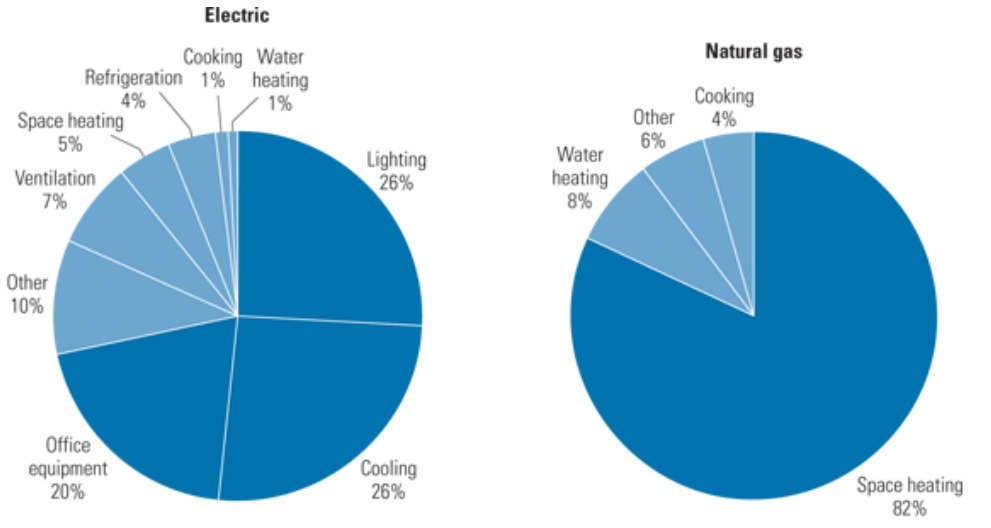
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
97.3	183.7	22

The school has an above average Energy Star Rating Score (50 being the median score), and is considered an energy efficient building.

The school has a below average Energy Star Rating Score (50 being the median score), and as such by implementing the measures discussed in this report, it is expected that the EUI can be further reduced and the Energy Star Rating further increased. Additional EPA Portfolio Manager Data can be found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Install Infrared Heaters to Replace Gas-Fired Unit Heaters

The shop classroom areas have (6) natural gas-fired unit heaters, each having a capacity of 50,000 btu/hr to supplement the H&V unit heating capacity. These unit heaters are in poor condition and appear to be original to building construction. Unit heaters heat the spaces somewhat inefficiently as they heat the air in the space. Due to the fact that the areas have large overhead garage doors that are frequently left open, heating the space requires a high amount of natural gas consumption because the unit heaters must heat a large volume of outside air. It is proposed to replace these unit heaters with natural gas-fired infrared heaters. Infrared heaters heat objects under them as opposed to the air in the space and are considered to have a higher heating effectiveness per ASHRAE. Natural gas savings results in improved heating effectiveness and combustion efficiency of the infrared heaters as compared to the existing unit heaters.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Install Infrared Heaters to Replace Gas-Fired Unit Heaters

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
33,274	0	0	688	0	1,047	(0.6)	3000	31.0	28.2

* Incentive based on the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended

5.2.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of 400 watt mercury vapor and T8 linear fluorescent fixtures which until recently represented the most efficient lighting technology available. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
30,402	9.8	20,467	0	2,240	0.4	4,200	13.6	11.7

* Incentive based on the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.3 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train custodians to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate maintenance staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.05/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding

bonds or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. However, there is insufficient roof for a solar photovoltaic array and it would not practical at this location.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

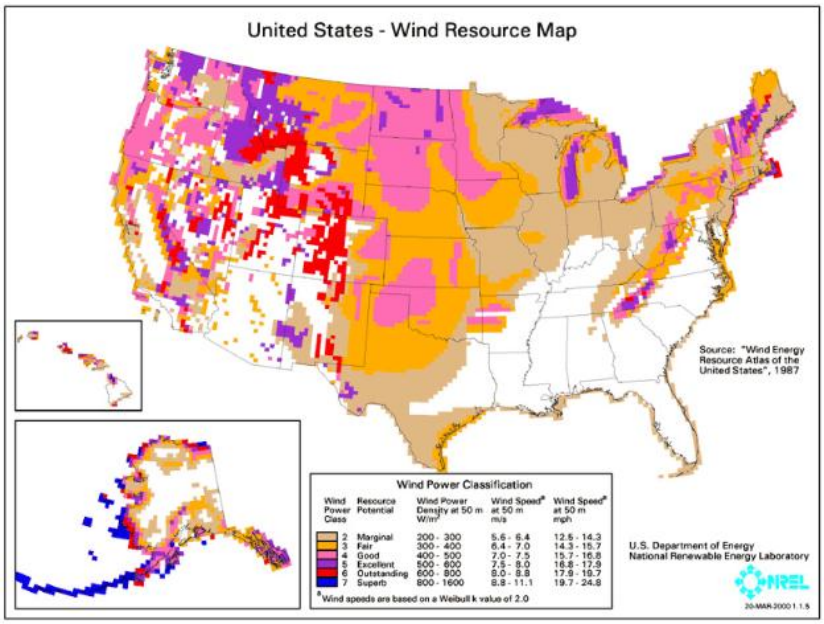
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development

Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

This measure is not recommended because the building does not have adequate load to meet the required minimum load reduction.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building Name.

The following projects should be considered for implementation:

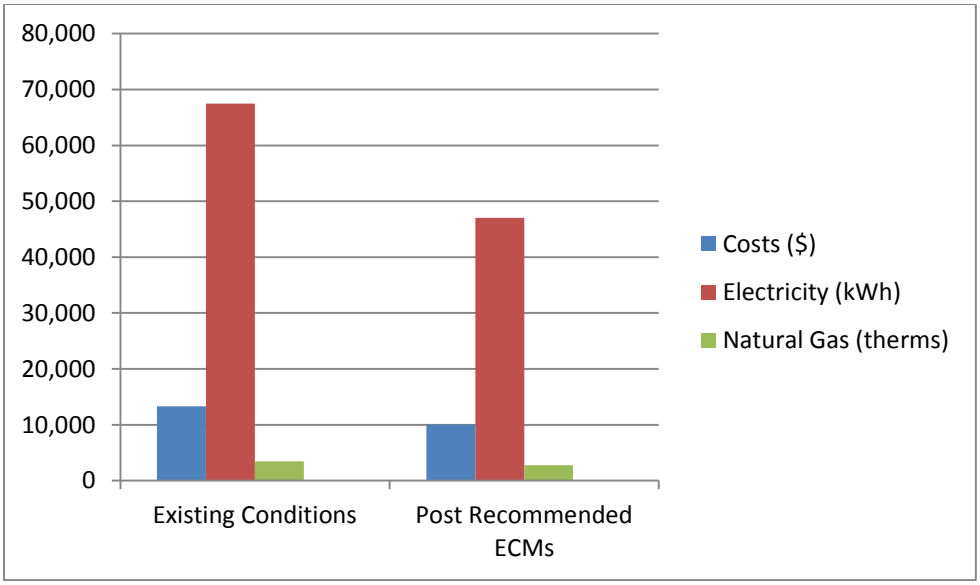
- Install Infrared Heaters to Replace Gas-Fired Unit Heaters
- Lighting Replacement / Upgrades

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
20,467	688	3,314	17.0

If the Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	13,331	10,017	25%
Electricity (kWh)	67,476	47,009	30%
Natural Gas (therms)	3,439	2,751	20%
Site EUI (kbtu/SF/Yr)	7.2	5.4	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 5 Gas
400 East Main Street, Denville, NJ 07834

Annual Utilities
12-month Summary

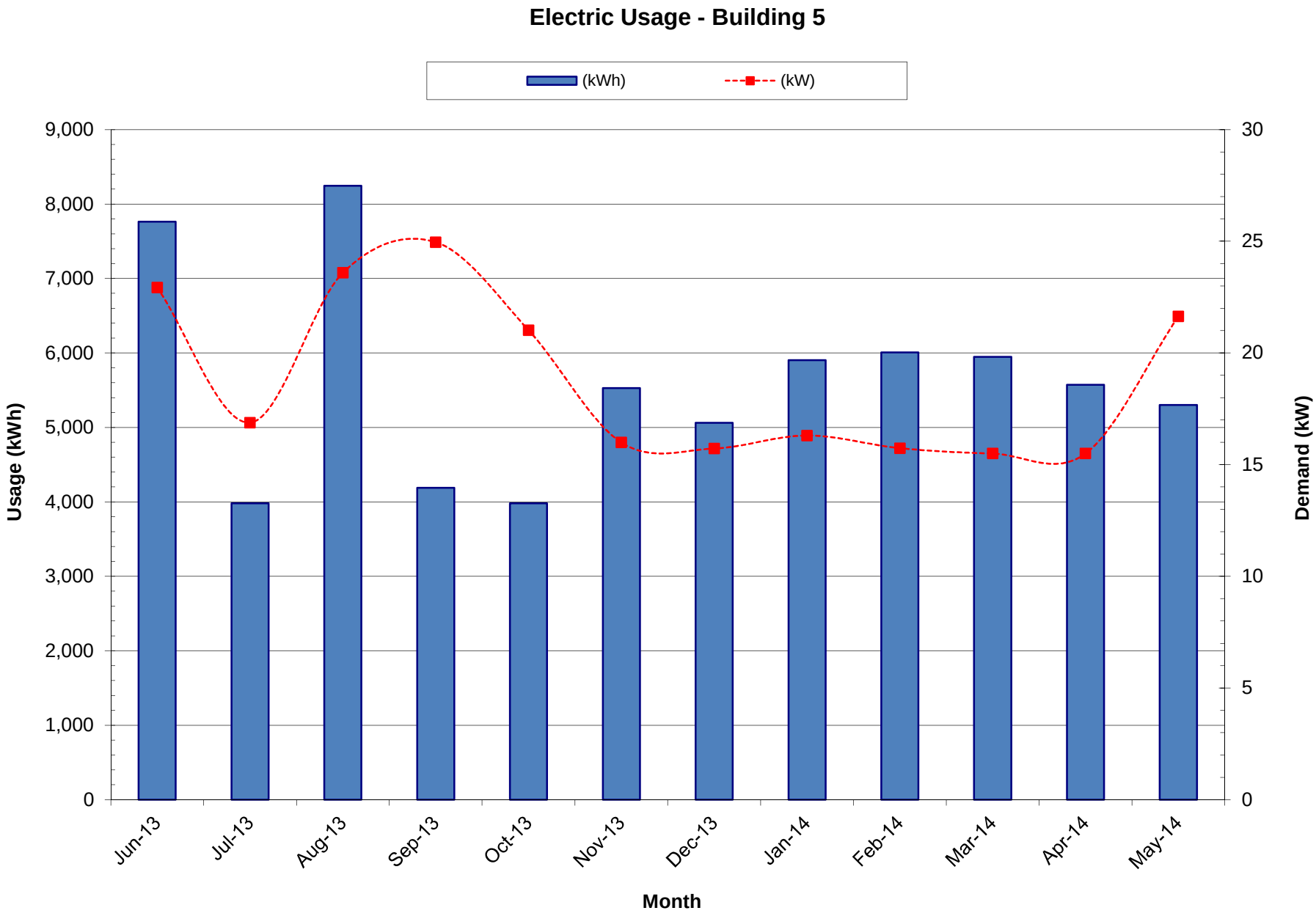
Electric		
Annual Usage	67,476	kWh/yr
Annual Cost	7,959	$
Blended Rate	0.118	$/kWh
Consumption Rate	0.091	$/kWh
Demand Rate	6.43	$/kW
Peak Demand	25.0	kW
Min. Demand	15.5	kW
Avg. Demand	18.8	kW
Natural Gas		
Annual Usage	3,439	Therms/yr
Annual Cost	5,372	$
Rate	1.562	$/therm
Water		
Annual Usage	820	kgals/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 5 Gas
400 East Main Street, Denville, NJ 07834

For Service at:
Account No.: **100000077717** **Delivery -** JCP & L
Meter No.: **L86699237** **Supplier -** First Energy Solutions Corp.
Electric Service

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	**Consump. (kWh)**	**Demand (kW)**	**Delivery ($)**	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Blended Rate ($/kWh)**	**Consumption ($/kWh)**	**Demand ($/kW)**
June-13	7,764	22.9	291.00	620.37	911.37	752.23	159.14	0.12	0.10	6.94
July-13	3,980	16.9	183.24	317.99	501.23	0.00	113.90	0.13	0.00	6.75
August-13	8,245	23.6	303.50	658.77	962.27	798.57	163.70	0.12	0.10	6.94
September-13	4,190	25.0	234.34	334.78	569.12	407.64	161.48	0.14	0.10	6.47
October-13	3,980	21.0	159.09	317.99	477.08	386.41	90.67	0.12	0.10	4.31
November-13	5,527	16.0	198.71	441.58	640.29	536.83	103.45	0.12	0.10	6.47
December-13	5,061	15.7	187.25	404.38	591.63	489.91	101.72	0.12	0.10	6.47
January-14	5,902	16.3	198.33	471.58	669.91	564.42	105.49	0.11	0.10	6.47
February-14	6,007	15.7	196.25	479.98	676.22	574.41	101.81	0.11	0.10	6.47
March-14	5,947	15.5	193.78	475.18	668.96	568.70	100.26	0.11	0.10	6.47
April-14	5,572	15.5	188.09	445.18	633.27	533.01	100.26	0.11	0.10	6.47
May-14	5,301	21.6	234.10	423.58	657.68	507.53	150.15	0.12	0.10	6.94
Total (All)	**67,476**	**24.96**	**$2,567.67**	**$5,391.36**	**$7,959.03**	**$6,119.66**	**$1,452.04**	**$0.12**	**$0.09**	**$6.43**
Total (last 12-months)	**67,476**	**24.96**	**$2,567.67**	**$5,391.36**	**$7,959.03**	**$6,119.66**	**$1,452.04**	**$0.12**	**$0.09**	**$6.43**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)

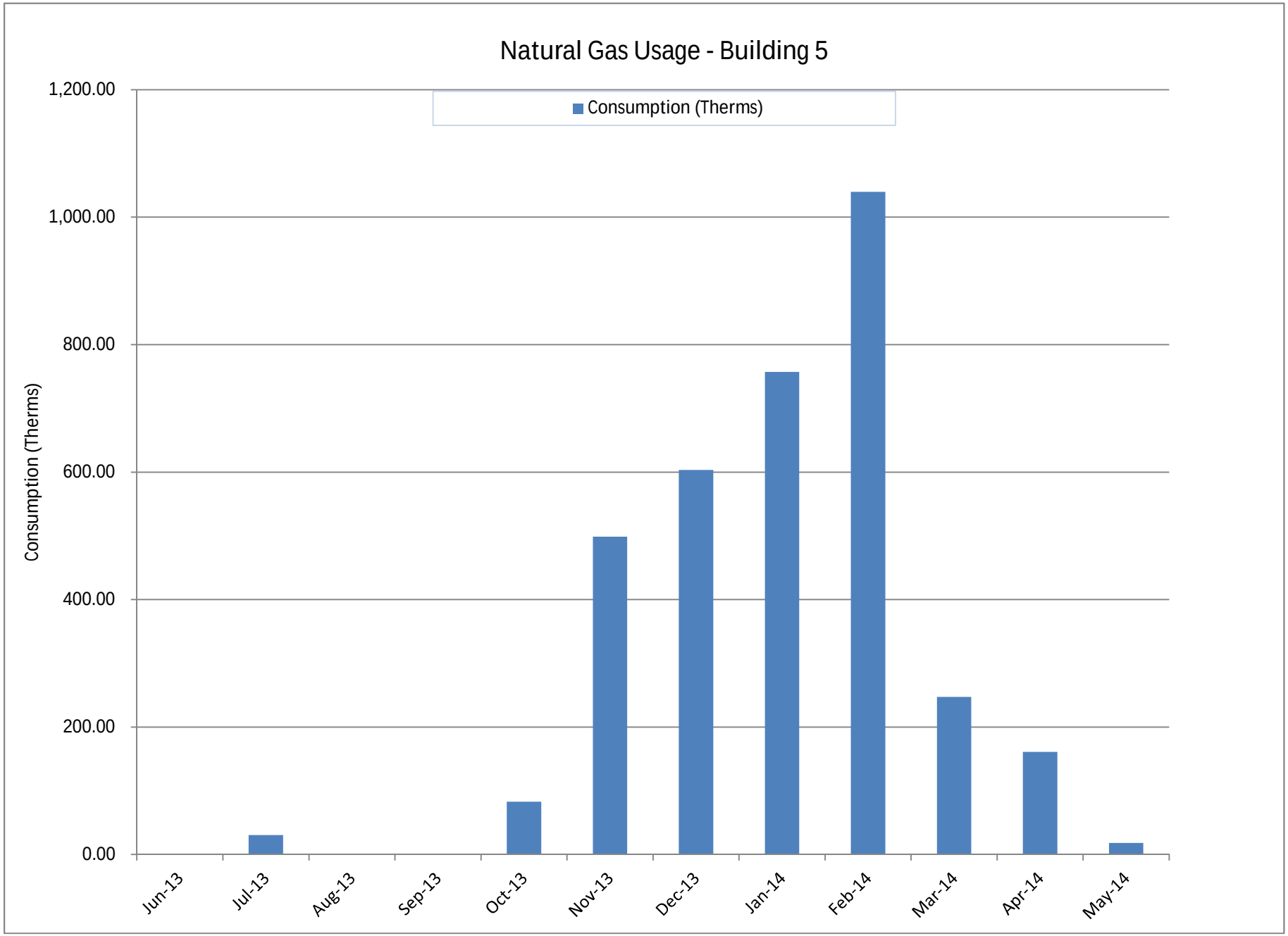


Utility Data -Building 5.xlsx
Electric Graph

Building 5 Gas
400 East Main Street, Denville, NJ 07834

For Service at: **400 East Main Street, Denville, NJ 07834**
Account No.: **181287978915**
Meter No: **600946**
Natural Gas Service **Delivery -** **New Jersey Natural Gas**
Supplier - **New Jersey Natural Gas**

		Charges		Unit Costs	
Month	**Consumption (Therms)**	**Delivery ($)**	**Total ($)**	**Delivery ($/Therm)**	**Total ($/Therm)**
June-12	0.00	$ 108.92	$ 108.92	$ -	$ -
July-12	0.00	$ 155.61	$ 155.61	$ -	$ -
August-12	0.00	$ 155.61	$ 155.61	$ -	$ -
September-12	0.00	$ 155.61	$ 155.61	$ -	$ -
October-12	253.96	$ 375.49	$ 375.49	$ 1.479	$ 1.479
November-12	357.61	$ 481.80	$ 481.80	$ 1.347	$ 1.347
December-12	566.12	$ 682.06	$ 682.06	$ 1.205	$ 1.205
January-13	622.60	$ 726.78	$ 726.78	$ 1.167	$ 1.167
February-13	602.46	$ 703.43	$ 703.43	$ 1.168	$ 1.168
March-13	480.93	$ 594.41	$ 594.41	$ 1.236	$ 1.236
April-13	75.86	$ 228.34	$ 228.34	$ 3.010	$ 3.010
May-13	7.51	$ 163.06	$ 163.06	$ 21.712	$ 21.712
June-13	0.00	$ 155.61	$ 155.61	$ -	$ -
July-13	30.49	$ 185.28	$ 185.28	$ 6.077	$ 6.077
August-13	0.00	$ 280.09	$ 280.09	$ -	$ -
September-13	1.08	$ 156.64	$ 156.64	$ 145.037	$ 145.037
October-13	82.74	$ 202.52	$ 202.52	$ 2.448	$ 2.448
November-13	498.59	$ 652.91	$ 652.91	$ 1.310	$ 1.310
December-13	603.33	$ 727.30	$ 727.30	$ 1.205	$ 1.205
January-14	757.33	$ 884.67	$ 884.67	$ 1.168	$ 1.168
February-14	1,039.65	$ 1,193.59	$ 1,193.59	$ 1.148	$ 1.148
March-14	247.22	$ 403.87	$ 403.87	$ 1.634	$ 1.634
April-14	160.83	$ 353.81	$ 353.81	$ 2.200	$ 2.200
May-14	18.22	$ 175.47	$ 175.47	$ 9.631	$ 9.631
Total (12 Months)	**3,439**		**$ 5,371.76**		**$ 1.562**


Natural Gas Usage - Building 5
Consumption (Therms)
1,200.00
1,000.00
800.00
600.00
400.00
200.00
0.00
Consumption (Therms)
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

Back to main supplier information page

APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	NJ Protocols		
														Current year	Years Old	life expectancy
Unit Heaters	5	6	Trane	Not Accessible	Various	Gas-Fired Unit Heater	Estimated 50 MBH Each	80%	Garage Bays	Garage Heating	1997	3		2014	17	20

Morris County Vocational Technical School LGEA - Building 4
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.38 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
146LED	Garage Bay 1	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 1	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
146LED	Garage Bay 2	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 2	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
146LED	Garage Bay 3	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 3	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
146LED	Garage Bay 4	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 4	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
146LED	Garage Bay 5	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 5	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
146LED	Garage Bay 6	Mechanical Room	4	High Bay MV 400	MV400/1	455	1.82	SW	2080	3,786	NONE	
54LED	Garage Bay 6	Mechanical Room	6	B 34 W F 2 (MAG)	F42EE	72	0.43	SW	2080	899	NONE	
	Total		**60**				**13.51**			**28,105**		

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide	Building Area	Annual Utility Cost		
$ 0.120	$/kWh blended		0.000420205	79,925	Electric	Natural Gas	Fuel Oil
$ 0.090	$/kWh supply	67,476	0.000420205		$ 7,959	$ 5,372	$ -
$ 3.38	$/kW	25.2	0				
$ 1.56	$/Therm	3,439	0.00533471				
$ 9.00	$/kgals	-	0				
$ -	$/Gal	-					

Building 5

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Install Infrared Heaters to Replace Gas-Fired Unit Heaters	0.0	0	688	0	0	1,074	$ 33,274	31.0	15.0	3.7	$ 3,000	N	28.2	0.0	0	10,317	0	$16,115	(0.5)	($17,448)	-7.0%
Y	ECM-L1	Lighting Replacements / Upgrades	9.8	20,467	0	0	0	2,240	$ 30,402	13.6	15.0	8.6	$ 4,200	N	11.7	147.0	307,005	0	0	$42,803	0.4	$533	3.3%
		Total (Not Including [B] Option ECMs or L1, L2)	**9.8**	**20,467**	**688**	**0**	**0**	**$ 3,314**	**$ 63,676**	**19.2**	**15.0**	**12**	**$ 7,200**		**17.0**	**147**	**307,005**	**10,317**	**-**	**$58,918**	**(0.1)**	**($16,915)**	**-1.6%**
		Recommended Measures (highlighted green above)	**9.8**	**20,467**	**688**	**0**	**0**	**$ 3,314**	**$ 63,676**	**19.2**	**15.0**	**12**	**$ 7,200**	**0**	**17.0**	**147**	**307,005**	**10,317**	**-**	**$58,918**	**(0.1)**	**($16,915)**	**-1.6%**
		% of Existing	**39%**	**30.33%**	**20.00%**	**-**	**-**																

	City:	Newark, NJ				
	Occupied Hours/Week	75	75	75	75	50
		Building Operating Hours	Auditorium Occupied Hours	Gymnasium Occupied Hours	Library Occupied Hours	Classrooms Occupied Hours
Temp	Enthalpy h (Btu/lb)	Bin Hours				
102.5						
97.5	35.4	6	3	3	3	2
92.5	37.4	31	14	14	14	9
87.5	35.0	131	58	58	58	39
82.5	33.0	500	223	223	223	149
77.5	31.5	620	277	277	277	185
72.5	29.9	664	296	296	296	198
67.5	27.2	854	381	381	381	254
62.5	24.0	927	414	414	414	276
57.5	20.3	600	268	268	268	179
52.5	18.2	730	326	326	326	217
47.5	16.0	491	219	219	219	146
42.5	14.5	656	293	293	293	195
37.5	12.5	1,023	457	457	457	304
32.5	10.5	734	328	328	328	218
27.5	8.7	334	149	149	149	99
22.5	7.0	252	113	113	113	75
17.5	5.4	125	56	56	56	37
12.5	3.7	47	21	21	21	14
7.5	2.1	34	15	15	15	10
2.5	1.3	1	0	0	0	0
-2.5						
-7.5						

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

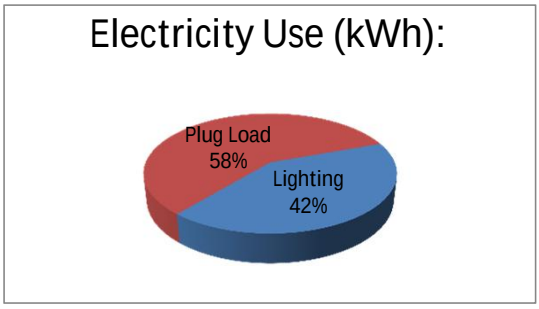
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

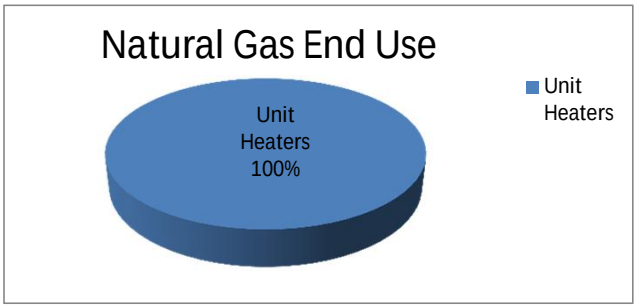
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 5

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
67,476	Total	Based on utility analysis	
28,105	Lighting	From Lighting Calculations	0.416516568
39,371	Plug Load	Estimated	0.583483432
Natural Gas Use (Therms):		**Notes/Comments:**	
3,439	Total	Based on utility analysis	
3,439	Unit Heaters	Therms/SF x Square Feet Served	1





Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 5

ECM-1: Replace Unit Heaters with 2-Stage Infrared Heaters

EXISTING CONDITIONS		
Existing Unit Heater Total Natual Gas Usage	3,439	Therms
Existing Infrared Equipment Usage	233,852	Mbtu/yr
Proposed Heating Gas Usage	2,751	Therms
Total energy savings	688	Therms
Total cost savings	$1,074	

Assumptions

	$ 1.56	$/Therm
1	80%	Existing Unit heater operating efficiency
2	85%	Existing Unit Distribution Effectiveness
3	85%	Proposed infrared heater operational efficiency
4	100%	Proposed Unit Distribution Effectiveness
5	$2,250	New 2-Stage Infrared Heater
6	6	Number of existing unit heaters to be replaced

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 5

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Replace Unit Heaters with 2-Stage Infrared Heaters - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Two-Stage Ceiling Mounted Radiant Heater	6	EA	$ 2,500	$ 1,500	INC	$ 15,405	$ 11,214	INC	$ 26,619	Grainger.com
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 26,619	Subtotal
$ 6,655	25% Contingency
$ 33,274	**Total**

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 5

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be met:

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	79,925
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$7,959	$5,372
Existing Usage (from utility)	67,476	3,439
Proposed Savings	20,467	688
Existing Total MMBtus	574	
Proposed Savings MMBtus	139	
% Energy Reduction	**24.1%**	
Proposed Annual Savings	$3,314	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.11	$1.25

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$2,251	$860	$3,111
Incentive #3	$2,251	$860	$3,111
Total All Incentives	**$4,503**	**$1,720**	**$11,222**

Total Project Cost	$63,676

		Allowable Incentive
% Incentives #1 of Utility Cost*	37.5%	$5,000
% Incentives #2 of Project Cost**	4.9%	$3,111
% Incentives #3 of Project Cost**	4.9%	$3,111
Total Eligible Incentives***	**$11,222**	
Project Cost w/ Incentives	$52,454	

Project Payback (years)	
w/o Incentives	w/ Incentives
19.2	15.8

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.
** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.
*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 4

CHA Project No. 28950

ECM-L1 Lighting Replacements

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
Field Code	Area Description Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of Fixtures No. of fixtures before the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Fixt No.)	Exist Control Pre-inst. control device	Annual Hours Estimated daily hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Number of Fixtures No. of fixtures after the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Number of Fixtures)	Retrofit Control Retrofit control device	Annual Hours Estimated annual hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Annual kWh Saved (Original Annual kWh) - (Retrofit Annual kWh)	Annual kW Saved (Original Annual kW) - (Retrofit Annual kW)	Annual $ Saved (kWh Saved) * ($/kWh)	Retrofit Cost Cost for renovations to lighting system	NJ Smart Start Lighting Incentive Prescriptive Lighting Measures	Simple Payback With Out Incentive Length of time for renovations cost to be recovered	Simple Payback Length of time for renovations cost to be recovered
146LED	Garage Bay 1	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 1	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
146LED	Garage Bay 2	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 2	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
146LED	Garage Bay 3	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 3	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
146LED	Garage Bay 4	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 4	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
146LED	Garage Bay 5	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 5	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
146LED	Garage Bay 6	4	High Bay MV 400	MV400/1	455	1.8	SW	2080	3,786	4	BAYLED78W	BAYLED78W	93	0.4	SW	2,080	774	3,012	1.4	$ 329.80	$ 3,376.78	$400	10.2	9.0
54LED	Garage Bay 6	6	B 34 W F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	STLED4	STLED4	40	0.2	SW	2,080	499	399	0.2	$ 43.73	$ 1,690.20	$300	38.7	31.8
	Total	**60**				**13.5**			**28,105**	**60**			**798**	**3.7**			**7,638**	**20,467**	**9.8**	**$2,241**	**$30,402**	**$4,200**		
																	Demand Savings			**9.8**	**$399**			
																	kWh Savings			**20,467**	**$1,842**			
																	Total savings				**$2,241**		**13.6**	**11.7**

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

Home | Residential | Commercial & Industrial | Renewable Energy
About Us | Press Room | Library | FAQs | Calendar | Newsletters | Contact Us | Site

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

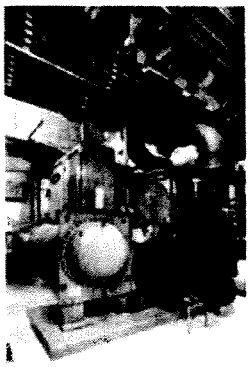
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

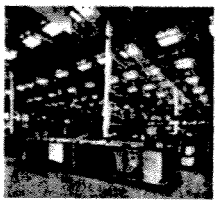
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

Home | Residential | Commercial & Industrial | Renewable Energy
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New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

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CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX E

Photovoltaic Analysis

APPENDIX F

Photos

No Photos available for Building 5

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

22

ENERGY STAR® Score[1]

Building 5

Primary Property Function: K-12 School
Gross Floor Area (ft²): 5,900
Built: 1997

For Year Ending: May 31, 2014
Date Generated: October 28, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Building 5 400 East Main Street Denville, New Jersey 07834	Morris County Vocational School District 400 E Main Street Denville, NJ 07834 (____)____-_____	Mike Orlovsky 400 E Main Street Denville, NJ 07834 (518)453-3980 mdewein@chacompanies.com

Property ID: 4195941

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
97.3 kBtu/ft²

Source EUI
183.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	230,228 (40%)
Natural Gas (kBtu)	343,948 (60%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	74.8
National Median Source EUI (kBtu/ft²)	141.3
% Diff from National Median Source EUI	30%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	49

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

MORRIS COUNTY VOCATIONAL SCHOOL DISTRICT
BUILDING 6
400 East Main Street, Denville, NJ 07834

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

October 2014

Prepared by:

6 Campus Drive
Parsippany, NJ 07054
(973) 538-2120

CHA PROJECT NO. 28950

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REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for Morris County Vocational School District's Building 6 in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost are also identified during the study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Building 6	400 E Main St, Denville, NJ 07834	39,845	2004

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

Electric Savings (kWh)	NG Savings (therms)	Total Savings ($)	Payback (years)
97,886	2,982	13,385	12.2

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for Lighting ECM savings; only one option can be chosen. Incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/ applicable and are discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period, based on the need to replace that piece(s) of equipment due to its age, such as a boiler for example.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

Summary of Energy Conservation Measures

ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
1	Install Condensing Boiler for Shoulder Months	67,010	3,357	20.0	2,625	19.2	Y
2	Install Heating Hot Water Pump VFDs & Premium Motors	9,845	2,258	4.4	3,208	2.9	Y
L1	Lighting Replacements / Upgrades	104,759	6,585	15.9	17,100	13.3	N
L2	Install Lighting Controls (Add Occupancy Sensors)	4,590	3,532	1.3	595	1.1	N
L3	Lighting Replacements with Controls (Occupancy Sensors)	109,349	7,769	14.1	17,695	11.8	Y
	Total**	186,204	13,358	14	23,528	12	
	Total (Recommended)	186,204	13,358	14	23,528	12	

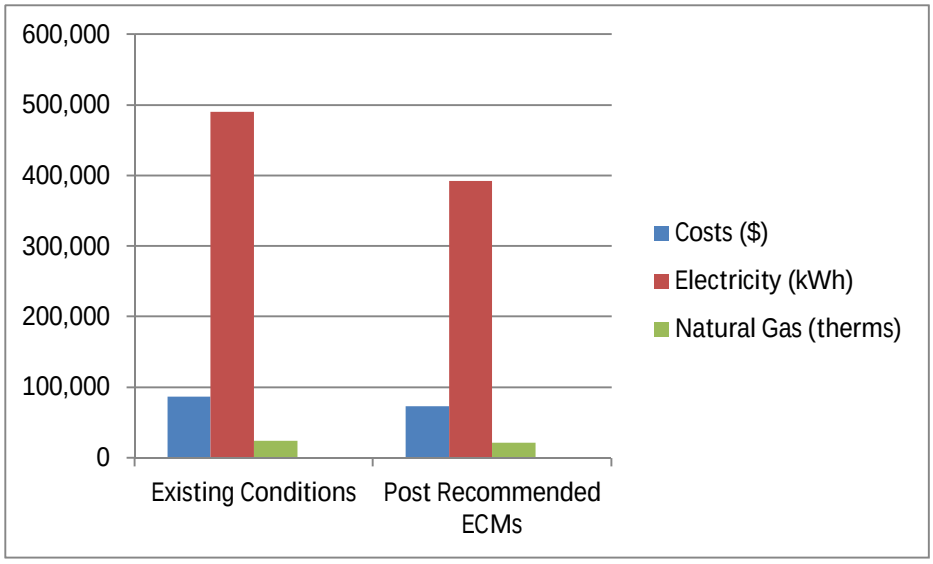
* Incentive shown is per the New Jersey SmartStart Program.
** These ECMs are not included in the Total, as they are alternate measures not recommended.

The following alternative energy measures are also recommended for further study:

- Photovoltaic (PV) Rooftop Solar Power Generation – 30 kW System

If Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

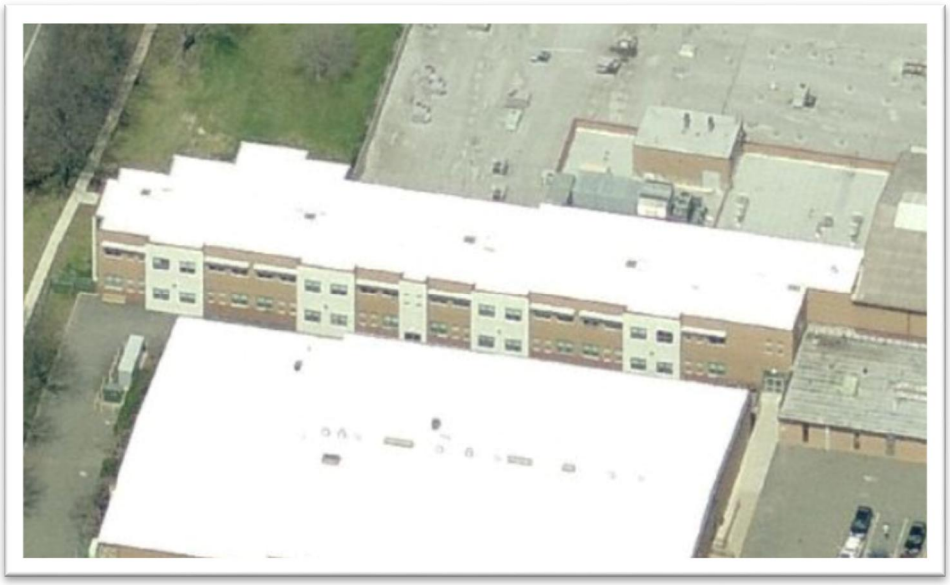
	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	81,604	68,366	16%
Electricity (kWh)	455,694	357,808	21%
Natural Gas (therms)	24,730	21,748	12%
Site EUI (kbtu/SF/Yr)	101.1	85.2	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHAs site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for some representative photos of some of the existing conditions observed while onsite.

Building Name: Building 6
Gross Floor Area: 39,845
Number of Floors: 2
Year Built: 2004
Additions: None



Description of Spaces: Classrooms, offices, gymnasium, storage rooms, toilet rooms and a mechanical room.
Description of Occupancy: This building houses classroom spaces for secondary or high school level and post-secondary/adult vocational and technical education.
Number of Computers: The school has approximately 40 desktop computers.
Building Usage: The secondary school hours of operation are 8:15 AM – 3:00 PM Monday through Friday, with various post-secondary activities until 6:00 PM. Custodians are in the building until 11:00 each night. In general the occupied hours are considered 80 hours per week, 10 months per year

Building Envelope

Construction Materials: Steel framed concrete masonry unit (CMU) exterior walls.
Façade: Brick exterior fascia.
Roof: Concrete and metal roof decking with minimal insulation, rolled asphalt roof finish. The roof appeared to be in fair condition, and no related ECMs are included.
Windows: Double pane with aluminum frames. The windows appeared to be in good condition and no related ECMs are included.
Exterior Doors: Double pane full window doors with aluminum frames. The door sweeps and seals appeared to be in good condition, and no related ECMs are included.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating & Cooling: This building is heated using heating hot water supplied by two Raypack natural gas-fired standard efficiency (84%) boilers installed in 2004. These boilers serve perimeter fin tube radiation, reheat coils in VAV boxes and a preheating coil in the main rooftop air handling unit (RTU). Hot water produced by these boilers is assumed to follow a reset schedule based on outside air temperature. Heating hot water is distributed by (2) 10 HP heating hot water supply pumps that operate in a lead/lag fashion. This heating hot water system is new and in good condition, but it is inefficient and can be improved.

An ECM has been included to install a high efficiency condensing boiler to supplement the existing boiler system and maximize overall system efficiency. Another ECM has been included to install premium efficiency heating hot water pump motors and VFDs to allow for the system to modulate water flow dependent on actual load requirements.

Heating, ventilation and air conditioning is provided by one CoolBreeze packaged RTU. This unit has a heating hot water coil served by the boiler plant, and a refrigerant coil served by an approximately 120 ton air cooled refrigerant chiller. The chiller is paired with a closed circuit evaporative cooling tower that is used for heat rejection. In addition to the chiller, the unit also has a swamp cooler that provides evaporative “free” cooling when weather conditions allow. The supply and return fans are fitted with a variable frequency drives (VFDs) to allow for modulation of airflow based on system static pressure changes. This packaged unit serves a variable air volume (VAV) distribution system with associated VAV boxes located near the spaces they serve. The supply and exhaust/return fans modulate to maintain a static pressure set point dependent on the position of the damper within the VAV boxes. This unit and associated distribution systems appear to be good condition.

Exhaust: Exhaust for the classrooms and corridors is provided by the packaged RTU described above. Exhaust for toilet rooms is provided by fractional HP roof mounted exhaust fans that are connected to the DDC system and controlled based on a set occupancy schedule.

Controls Systems

This building is being upgraded with the new campus-wide BAS system. The spaces are currently heated to 72°F occupied and 60°F unoccupied, and cooled to 76°F occupied and 85°F unoccupied. It is assumed that this new controls system will serve the needs of the facility and will operate effectively once installation is completed; therefore no controls related ECMs are being considered.

Domestic Hot Water Systems

Domestic hot water is provided by the water heater located in Building 1. This system consists of an AO Smith DHW boiler and approximately 400 gallon DHW storage tank. Water is provided at 140°F to the sinks in this building. This system is described in the Building 1 Report.

Kitchen Equipment

There is no kitchen in this building.

Plug Load

This school has computers with LCD monitors copiers, residential appliances (microwave, refrigerator), printers, portable electric heaters (personal) and vending machines which contribute to the plug load in the building. An ECM has been included to install computer network control software which reduces computer standby power consumption.

Plumbing Systems

All of the plumbing fixtures in this building are new and consume a low volume of water. Water closets, urinals, and lavatories are all equipped with automatic valves.

Lighting Systems

Lighting in this building is provided predominantly by T8 linear fluorescent and compact fluorescent recessed can fixtures. These fixtures are manually controlled by wall mounted switches in the spaces.

Three lighting ECMs have been included which include adding occupancy sensors to the existing lighting, replacement of the T-8 lighting with LED lighting and a third ECM that evaluates the effect of occupancy sensors used with the LED lighting upgrades.

3.0 UTILITIES

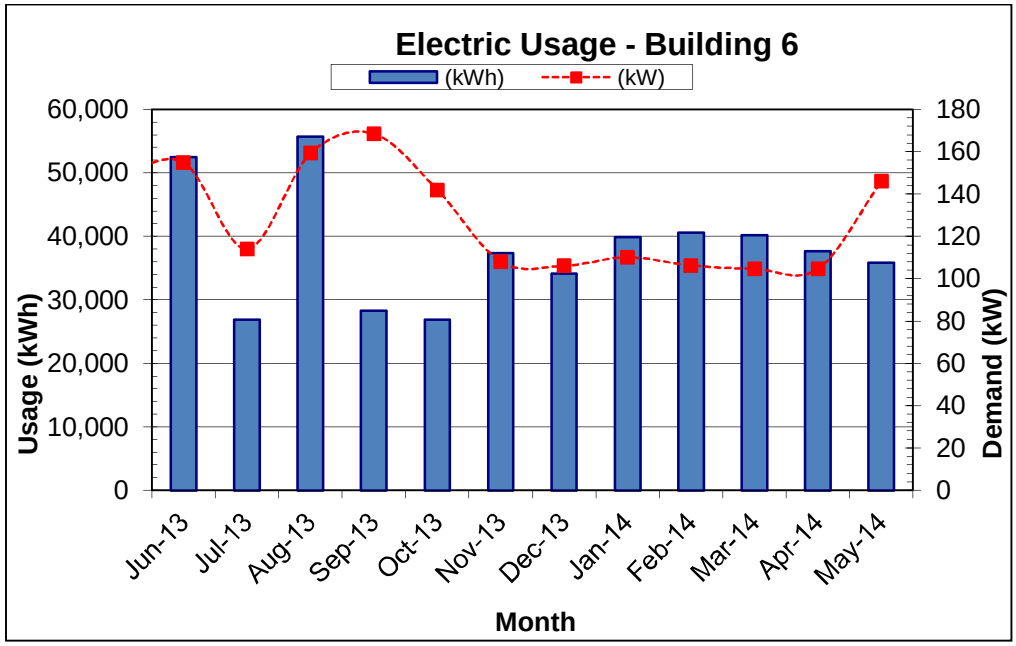
Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Natural Gas
Deliverer	JCP&L	New Jersey Natural Gas
Supplier	First Energy Solutions Corp.	New Jersey Natural Gas

For the 12-month period ending in May 2014, the utilities usages and costs for the building were as follows:

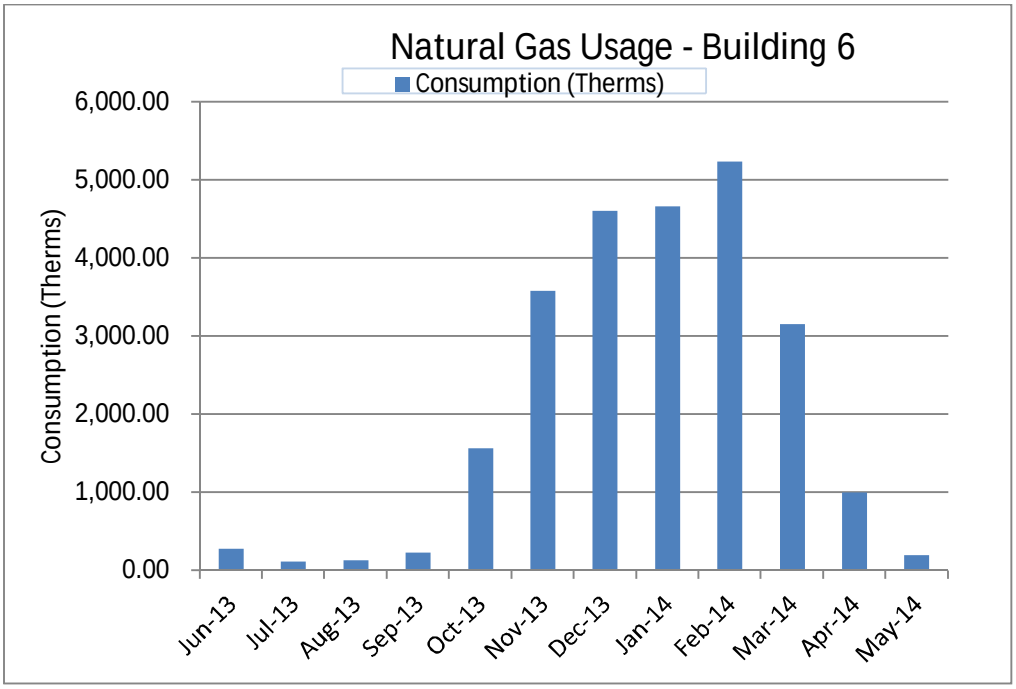
Electric		
Annual Consumption	455,694	kWh
Annual Cost	53,750	$
Blended Unit Rate	0.118	$/kWh
Supply Rate	0.091	$/kWh
Demand Rate	3.06	$/kW
Peak Demand	170.3	kW
Natural Gas		
Annual Consumption	24,730	Therms
Annual Cost	27,853	$
Unit Rate	1.126	$/therm

Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)



The electric usage presented in the graph above shows consumption that is typical of an air conditioned school, with peak electrical consumption and demand associated with summer months when cooling is in operation. Usage and demand appear to be low in

the month of July, 2013 which may be the result of the school being mostly shut down during that month.



The natural gas consumption presented in the graph above is typical of a school building with peak consumption occurring during the winter months when the heating load is at it's highest. From the graph, it is easy to tell that the consumption during the summer is predominantly used for domestic water heating as the building is not being heated.

In addition, domestic water and sewer services are provided by the Township of Denville at $9.00/1000 gal.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/ electric supplies through their wires and pipes – and respond to emergencies, should they arise – regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	School Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.12	$0.13	N
Natural Gas	$/Therm	$1.12	$0.96	N
Fuel Oil	$/Gal	NA	$3.62	NA

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

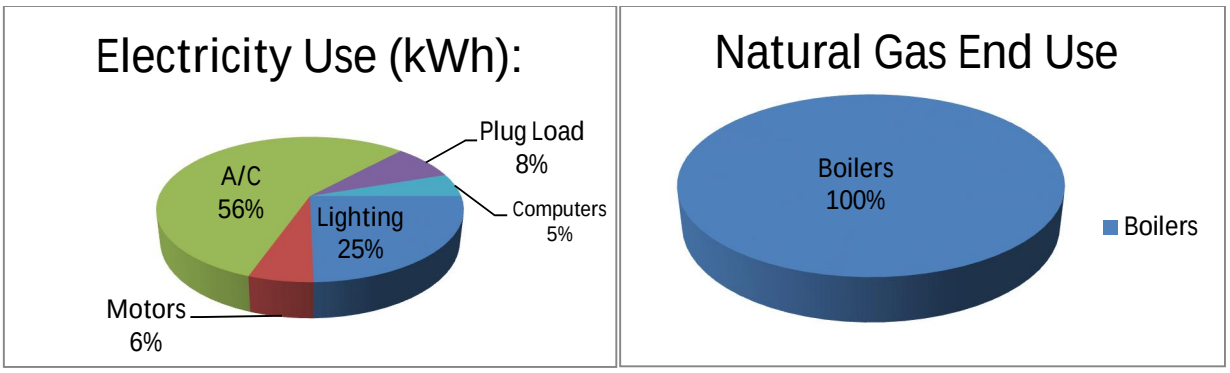
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

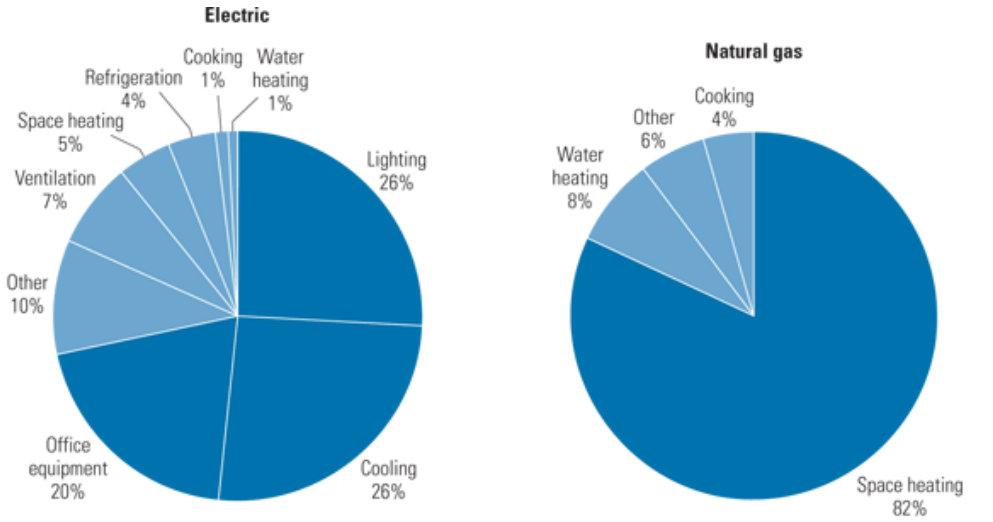
The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



Most of the electricity consumed by educational facilities is used to for lighting, cooling, and plug loads such as computers and copiers; most of the natural gas is used for space heating. Each school's energy profile is different, and the following charts represent typical utility profiles for K-12 schools per U.S. Department of Energy.

Typical End-Use Utility Profile for Educational Facilities



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft^2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100, with 100 being the most efficient. In order for a building to receive and Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase.

The site EUI is the amount of heat and electricity consumed by a building as reflected in utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity, such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site, which provide an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking are contained in the table below.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
101.1	187.7	8

The school has a below average Energy Star Rating Score (50 being the median score), and as such by implementing the measures discussed in this report, it is expected that the EUI can be further reduced and the Energy Star Rating further increased. Additional EPA Portfolio Manager data can be found in Appendix G.

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low- or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- electrical usage (kWh=Kilowatt-hour),
- electrical demand (kW=kilowatts),
- natural gas (therms=100,000 Btu),
- propane gas (gallons=91,650 Btu),
- fuel oil (gallons =138,700 Btu), and
- water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to "break even" referred to as "Simple Payback". Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment or ROI, which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment's future net cash flows and the initial investment. If the NPV equals "0", the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Install Condensing Boiler for Shoulder Months

The existing boiler plant consists of two 80% efficient boilers which are in good condition. It is proposed to supplement this boiler plant with a high efficiency condensing boiler that will operate in shoulder months. Condensing boilers can operate at efficiencies of over 96% when in condensing mode. It is assumed that the proposed boiler will maintain a seasonal efficiency of 90% within the calculations. Natural gas savings will result from a higher overall system efficiency.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Install Condensing Boiler for Shoulder Months

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
67,010	0	0	2,982	0	3,357	0.3	2,625	20.0	19.2

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.2 ECM-2 Install HHW Pump VFDs & Premium Motors

The existing 10 HP heating hot water (HHW) pump motors are standard efficiency (87.5%) are constant flow (speed). It is proposed to replace these motors with premium efficiency (90.5%) motors and install variable frequency drives (VFD) to allow for the pumps to modulate water flow based on actual heating load requirements. Electrical energy savings will result from a higher efficiency motors as well as reduced motor power draw during lower flow times.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Install HHW Pump VFDs & Premium Motors

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Water	Total				
$	kW	kWh	Therms	kGal	$		$	Years	Years
9,845	10.2	18,820	0	0	2,258	3.1	3,208	4.4	2.9

* Qualifies for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.3.1 ECM-L1 Lighting Replacement / Upgrades

The existing lighting system consists of mostly T8 linear fluorescent and compact fluorescent fixtures which until recently represented the most efficient lighting technology

available. Recent technological improvements in light emitting diode (LED) technologies have driven down the initial costs making it a viable option for installation.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacement / Upgrades

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
104,759	16.1	65,928	0	6,585	0.2	17,100	15.9	13.3

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is not recommended in lieu of ECM L3.

5.3.2 ECM-L2 Install Lighting Controls (Occupancy Sensors)

Presently, all interior lighting fixtures are controlled by wall mounted switches. Review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied.

This measure recommends installing occupancy sensors for the current lighting system. Using a process similar to that utilized in Section 5.7.1, the energy savings for this measure was calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L2 Install Lighting Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,590	0	29,434	0	3,532	10.5	595	1.3	1.1

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is not recommended in lieu of ECM L3.

5.3.3 ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

This measure is a combination of ECM-L1 and ECM-L2; recommending replace/upgrade the current lighting fixtures to more efficient ones and installing occupancy sensors on the new lights. Interactive effects of the higher efficiency lights and occupancy sensors lead the energy and cost savings for this measure to not be cumulative or equivalent to the sum of replacing the lighting fixtures alone and installing occupancy sensors without the lighting upgrade. The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-L3 Lighting Replacements with Controls (Occupancy Sensors)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
109,349	16.1	49,066	0	7,769	0.4	17,695	14.1	11.8

* LED retrofits must go through the "custom" measures incentive option under New Jersey SmartStart Program. There are no "prescriptive" incentives for LED retrofits. Projects must achieve a minimum of 75,000 kWh annual savings to qualify for "custom" incentives. See section 6.0 for other incentive opportunities

This measure is recommended.

5.4 Additional O&M Opportunities

This list of operations and maintenance (O&M) - type measures represent low-cost or no-cost opportunities, which if implemented will have a positive impact on the overall building operations, comfort and/or energy consumption. The recommended O&M measures for this building are as follows:

- Replace RTU filters at least twice a year
- Purchase ENERGY STAR® Kitchen Appliances
- Disconnect unnecessary or unused small appliances and electronics when not in use to reduce phantom loads
- Train custodians to turn off lights and set HVAC temperatures to minimum levels when rooms are unoccupied
- Develop an Energy Master Plan to measure and track energy performance
- Educate students and staff about how their behavior affects energy use. Create student energy patrols to monitor and inform administration when energy is being wasted.
- During the winter, Custodians should ensure all windows are closed as part of cleaning routine

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the School District wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs. Refer to Appendix D for more information on the Smart Start program.

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable frequency Drives/ motors
- Refrigeration
- Prescriptive and performance lighting and lighting controls

The equipment is procured using a typical bid- build method, installed and paid for and then the incentives are reimbursed to the owner.

Refer to Appendix D for more information on the Smart Start program.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install

participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the Owner upon successful replacement and payment of the equipment.

The building qualifies for this program because its electrical demand is less than the maximum peak electrical demand of 200 kW for the last 12 month period.

Refer to Appendix D for more information on this program.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 100 kW. This demand minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations and *is not applicable to public schools*. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.05/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.05 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

<u>Electric</u>

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C, with more detailed program information in Appendix D.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use "energy savings obligations" (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered "new general obligation debt" of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding bonds or leases. Savings generated from the installation of energy conservation measures pay

the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs. Refer to Appendix D for more information on this program.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The amount of available roof area determines how large of a solar array can be installed on any given roof. The table below summarizes the approximate roof area available on the building and the associated solar array size that can be installed.

Available Roof Area (Ft^2)	Potential PV Array Size (kW)
4,556	30

The PVWATTS solar power generation model was utilized to calculate PV power generation; this model is provided in Appendix E.

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey Solar Renewable Energy Certificates Program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. Payments that will be received by the PV producer (school) will change from year to year dependent upon supply and demand. There is no definitive way to calculate an exact price that will be received by the PV producer for SREC credits over the next 15 years. Renewable Energy Consultants estimates an average of $155/SREC for 2014 and this number was utilized in the cash flow for this report.

The system costs for PV installations were derived from recent solar contractor budgetary pricing in the state of New Jersey and include the total cost of the system installation (PV panels, inverters, wiring, ballast, controls). The cost of installation is currently about $4.00 per watt or $4,000 per kW of installed system, for a typical system. There are other considerations that have not been included in this pricing, such as the condition of the roof and need for structural reinforcement. Photovoltaic systems can be ground mounted if the roof is not suitable, however, this installation requires a substantial amount of open property (not wooded) and underground wiring, which adds more cost. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will most likely need to be replaced during the useful life of the PV system.

The implementation cost and savings related to this ECM are presented in Appendix E and summarized as follows:

Photovoltaic (PV) Rooftop Solar Power Generation – 10 kW System

Budgetary Cost	Annual Utility Savings			Total Savings	New Jersey Renewable SREC	Payback (without SREC)	Payback (with SREC)	Recommended
	Electricity		Natural Gas					
$	kW	kWh	Therms	$	$	Years	Years	Y/N
120,000	30	49,475	0	5,937	8,757	20.2	8.2	FS

Note: CHA typically recommends a more detailed evaluation be conducted for the installation of PV Solar arrays when the screening evaluation shows a payback of less than 20 years. Therefore, this ECM is recommended for further study. Before implementation is pursued, the school district should consult with a certified solar PV contractor.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

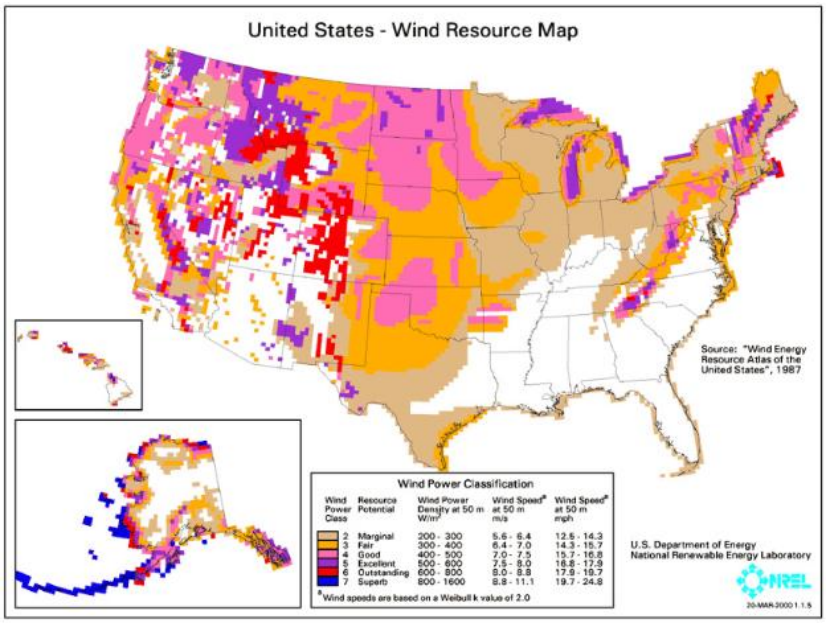
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this school is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the school.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are mounted onto a tower. Newer wind turbines also use advanced technology to generate

electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the school.

7.3 Combined Heat and Power Plant

Combined heat and power (CHP), cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the

heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation.

7.4 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the utility provider's regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and utility provider offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

This school district already participates in demand response program.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for Building Name.

The following projects should be considered for implementation:

- Install Condensing Boiler for Shoulder Months
- Install Heating Hot Water Pump VFDs & Premium Efficiency Motors
- Lighting Replacements with Controls

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

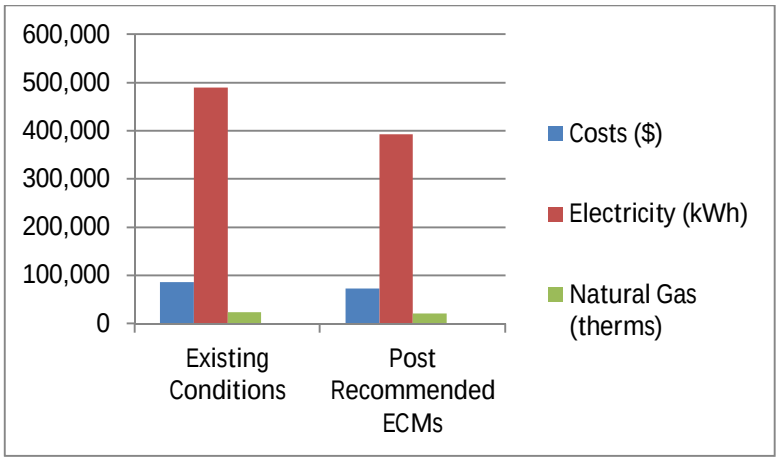
Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings ($)	Payback (years)
97,886	2,982	13,385	12.2

The following alternative energy measures are recommended for further study:

- Photovoltaic (PV) Rooftop Solar Power Generation – 30 kW System

If the Morris County Vocational School District implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs ($)	81,604	68,366	16%
Electricity (kWh)	455,694	357,808	21%
Natural Gas (therms)	24,730	21,748	12%
Site EUI (kbtu/SF/Yr)	101.1	85.2	



Next Steps: This energy audit has identified several areas of potential energy savings. Morris County Vocational School District can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with Morris County Vocational School District staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

Morris County Vocational Technical School District
Building 6
400 East Main Street, Denville, NJ 07834

Annual Utilities
12-month Summary

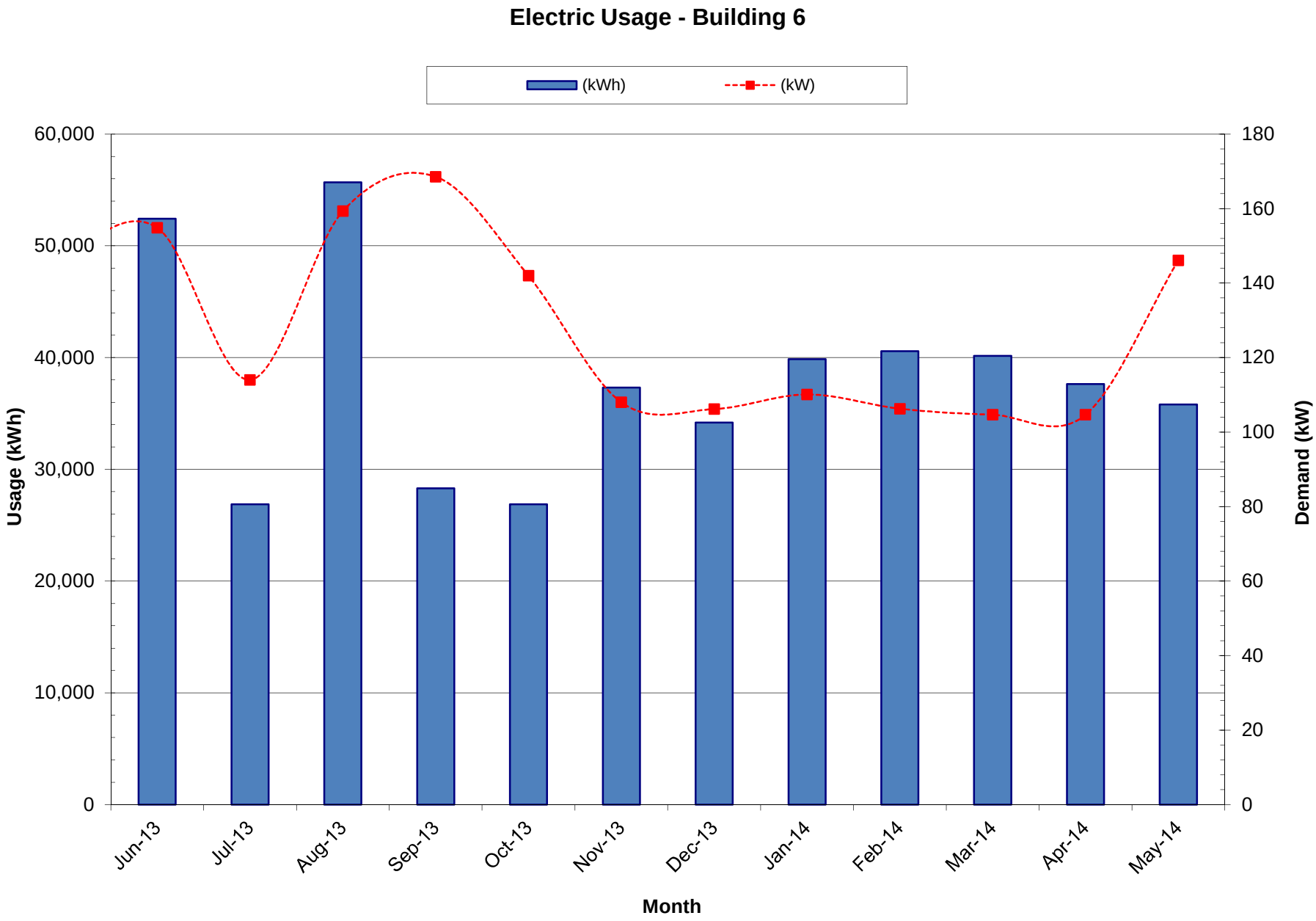
Electric		
Annual Usage	455,694	kWh/yr
Annual Cost	53,750	$
Blended Rate	0.118	$/kWh
Consumption Rate	0.091	$/kWh
Demand Rate	3.06	$/kW
Peak Demand	170.3	kW
Min. Demand	101.6	kW
Avg. Demand	128.2	kW
Natural Gas		
Annual Usage	24,730	Therms/yr
Annual Cost	27,853	$
Rate	1.126	$/therm
Water		
Annual Usage	820	gallons/yr
Annual Cost	7,252	$
Rate	8.843	$/gallon

Building 6
400 East Main Street, Denville, NJ 07834

For Service at:	**Building 3**					
Account No.:	**100000077717**	**Delivery -**	JCP & L	Building Area	39,845	SF
Meter No.:	**L86699237**	**Supplier -**	First Energy Solutions Corp.	% of Total Area Served	31.7%	%
Electric Service						

			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs		
Month	**Consump. (kWh)**	**Demand (kW)**	**Delivery ($)**	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Blended Rate ($/kWh)**	**Consumption ($/kWh)**	**Demand ($/kW)**
May-12	31,745	146.1	5,101.81	0.00	4,105.83	3,091.81	1,014.02	0.13	0.10	6.94
June-12	36,918	170.3	5,755.63	0.00	5,755.63	4,573.99	1,181.63	0.16	0.12	6.94
July-12	26,877	110.8	4,105.83	0.00	4,105.83	3,336.62	769.21	0.15	0.12	6.94
August-12	43,003	127.1	1,655.73	0.00	1,655.73	773.91	881.83	0.04	0.02	6.94
September-12	30,021	168.6	1,634.04	0.00	1,634.04	543.51	1,090.54	0.05	0.02	6.47
October-12	35,701	148.3	1,598.11	0.00	1,598.11	638.81	959.29	0.04	0.02	6.47
November-12	32,760	108.0	1,286.77	0.00	1,286.77	588.11	698.66	0.04	0.02	6.47
December-12	38,744	109.3	1,364.97	0.00	1,364.97	681.17	683.80	0.04	0.02	6.25
January-13	37,628	101.6	1,302.00	0.00	1,302.00	644.57	657.44	0.03	0.02	6.47
February-13	41,685	107.0	1,403.65	0.00	1,403.65	711.56	692.10	0.03	0.02	6.47
March-13	34,687	118.5	1,362.88	0.00	1,362.88	595.94	766.94	0.04	0.02	6.47
April-13	36,208	119.2	1,392.52	0.00	1,392.52	621.06	771.45	0.04	0.02	6.47
May-13	35,194	146.1	1,619.75	2,811.99	4,431.73	3,417.71	1,014.02	0.13	0.10	6.94
June-13	52,436	154.9	1,965.20	4,189.62	6,154.82	5,080.09	1,074.73	0.12	0.10	6.94
July-13	26,877	114.0	1,237.51	2,147.48	3,384.99	0.00	769.21	0.13	0.00	6.75
August-13	55,681	159.3	2,049.65	4,448.93	6,498.58	5,393.06	1,105.52	0.12	0.10	6.94
September-13	28,297	168.6	1,582.56	2,260.93	3,843.49	2,752.96	1,090.54	0.14	0.10	6.47
October-13	26,877	142.0	1,074.41	2,147.48	3,221.89	2,609.57	612.32	0.12	0.10	4.31
November-13	37,324	108.0	1,341.94	2,982.15	4,324.10	3,625.44	698.66	0.12	0.10	6.47
December-13	34,180	106.2	1,264.58	2,730.95	3,995.53	3,308.57	686.97	0.12	0.10	6.47
January-14	39,859	110.1	1,339.39	3,184.75	4,524.14	3,811.75	712.40	0.11	0.10	6.47
February-14	40,569	106.3	1,325.33	3,241.48	4,566.81	3,879.23	687.58	0.11	0.10	6.47
March-14	40,164	104.7	1,308.70	3,209.07	4,517.77	3,840.65	677.12	0.11	0.10	6.47
April-14	37,628	104.7	1,270.27	3,006.47	4,276.75	3,599.62	677.12	0.11	0.10	6.47
May-14	35,802	146.1	1,580.95	2,860.61	4,441.55	3,427.53	1,014.02	0.12	0.10	6.94
Total (All)	**916,864**	**170.26**	**$46,924.18**	**$39,221.91**	**$85,150.12**	**$61,547.23**	**$20,987.10**	**$0.09**	**$0.07**	**$6.55**
Total (last 12-months)	**455,694**	**168.55**	**$17,340.51**	**$36,409.93**	**$53,750.43**	**$41,328.46**	**$9,806.18**	**$0.12**	**$0.09**	**$3.06**
Notes	1	2	3	4	5	6	7	8	9	10

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider
5.) Total charges (Delivery + Supplier)
6.) Charges based on the number of kWh of electric energy used
7.) Charges based on the number of kW of power measured
8.) Total Charges ($) / Consumption (kWh)
9.) Consumption Charges ($) / Consumption (kWh)
10.) Demand Charges ($) / Demand (kW)



Utility Data -Building 6.xlsx
Building 6 Graph

Building 6
400 East Main Street, Denville, NJ 07834

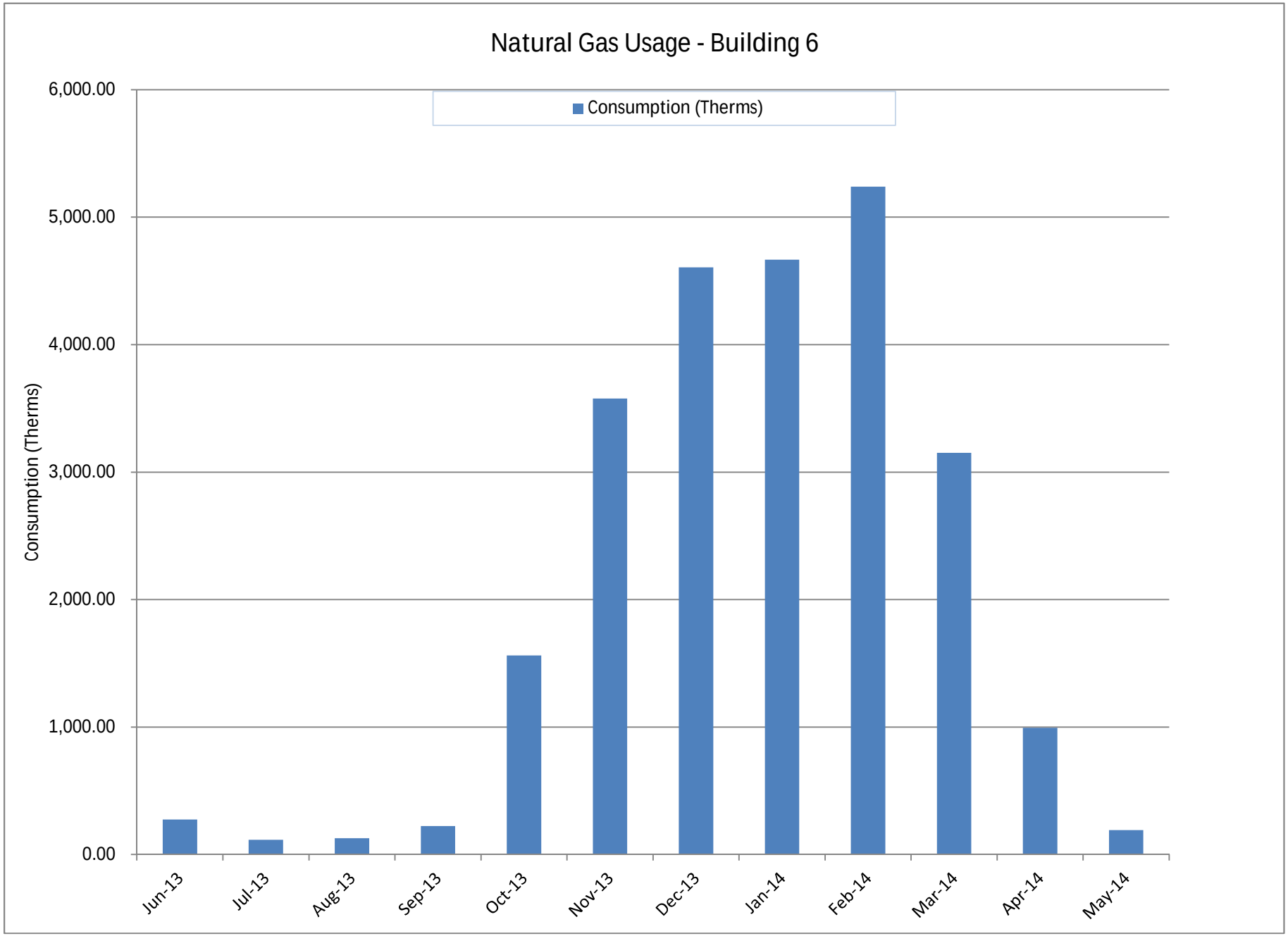
For Service at: **400 East Main Street, Denville, NJ 07834**
Account No.: **100000077717**
Meter No: **L86699237**
Natural Gas Service

Delivery - **New Jersey Natural Gas**
Supplier - **New Jersey Natural Gas**

Building 6 Consumption

Building Area 39,845 SF
% of Total Area Served 41.9% %

		Charges		Unit Costs	
Month	**Consumption (Therms)**	**Delivery ($)**	**Total ($)**	**Delivery ($/Therm)**	**Total ($/Therm)**
June-12	87.20	$ 232.59	$ 232.59	$ 2.667	$ 2.667
July-12	160.42	$ 596.15	$ 596.15	$ 3.716	$ 3.716
August-12	125.54	$ 382.52	$ 382.52	$ 3.047	$ 3.047
September-12	307.19	$ 523.03	$ 523.03	$ 1.703	$ 1.703
October-12	1,037.86	$ 1,176.03	$ 1,176.03	$ 1.133	$ 1.133
November-12	4,096.74	$ 4,014.18	$ 4,014.18	$ 0.980	$ 0.980
December-12	3,892.06	$ 3,896.71	$ 3,896.71	$ 1.001	$ 1.001
January-13	3,933.28	$ 3,885.80	$ 3,885.80	$ 0.988	$ 0.988
February-13	3,514.08	$ 3,472.78	$ 3,472.78	$ 0.988	$ 0.988
March-13	2,967.74	$ 2,985.16	$ 2,985.16	$ 1.006	$ 1.006
April-13	1,625.18	$ 1,832.91	$ 1,832.91	$ 1.128	$ 1.128
May-13	877.75	$ 1,148.10	$ 1,148.10	$ 1.308	$ 1.308
June-13	274.94	$ 550.17	$ 550.17	$ 2.001	$ 2.001
July-13	114.76	$ 389.11	$ 389.11	$ 3.391	$ 3.391
August-13	128.36	$ 399.19	$ 399.19	$ 3.110	$ 3.110
September-13	223.39	$ 491.02	$ 491.02	$ 2.198	$ 2.198
October-13	1,562.45	$ 1,752.87	$ 1,752.87	$ 1.122	$ 1.122
November-13	3,577.69	$ 3,678.01	$ 3,678.01	$ 1.028	$ 1.028
December-13	4,605.83	$ 4,641.73	$ 4,641.73	$ 1.008	$ 1.008
January-14	4,666.28	$ 4,769.52	$ 4,769.52	$ 1.022	$ 1.022
February-14	5,240.12	$ 5,407.79	$ 5,407.79	$ 1.032	$ 1.032
March-14	3,150.50	$ 3,785.24	$ 3,785.24	$ 1.201	$ 1.201
April-14	995.00	$ 1,503.61	$ 1,503.61	$ 1.511	$ 1.511
May-14	190.59	$ 485.00	$ 485.00	$ 2.545	$ 2.545
June-14	190.59	$ 485.00	$ 485.00	$ 2.545	$ 2.545
Total (12 Months)	**24,730**		**$ 27,853.27**		**$ 1.126**


Natural Gas Usage - Building 6
Consumption (Therms)
6,000.00
5,000.00
4,000.00
3,000.00
2,000.00
1,000.00
0.00
Consumption (Therms)
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14

JCP&L SERVICE TERRITORY
Last Updated: 9/04/14

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888) 987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. 309 Fellowship Road, Fl.2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC 103 Carnegie Center Suite 300 Princeton, NJ 08540	(877) 30-AMBIT (877) 302-6248 www.ambitenergy.com	**R/C** **ACTIVE**
American Powernet Management 437 Grove Street Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(201) 384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800)-451-6956 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**

Champion Energy Services, LLC 1200 Route 22 East Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	888-565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Choice Energy Services Retail, LP 30 Montgomery Street Suite 1410 Jersey City, NJ 07032	(888) 341-6370 www.choiceenergyservices.com	**R/C/I** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**

Direct Energy Business Marketing, LLC 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **INACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 464-4377 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, NJ 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions 395 Route 70 West, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.dom.com/products	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
FirstEnergy Solutions Corp. 150 West State Street Trenton, NJ 08608	(866) 625-7318 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08819	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**

610 Iselin, NJ 08830		
Liberty Power Delaware, LLC3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.NJGandE.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**

North American Power and Gas, LLC 222 Ridgedale Ave. Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 535-6340 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	856-778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC d/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
PPL EnergyPlus Retail, LLC 788 Shrewsbury Avenue, Suite 220 Tinton Falls, NJ 07724	(732) 741-0505 – 2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescomenergy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC **550 Broad Street** **Newark, NJ 07102**	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
SIMEC, LLC 116 Village Blvd. Suite 200 Princeton, NJ 08540	(917) 620-0249 www.simecenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ 08540	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**

Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Service, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylinks.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46 Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**

YEP Energy 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 10/24/12

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	855-553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	201-384-5552 www.astralenergyllc.com	**R/C/I** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C/I** **ACTIVE**
Clearview Electric Inc. **d/b/a Clearview Gas** 1744 Lexington Ave. Pennsauken, New Jersey 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**
Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	(888) 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 1085 Morris Avenue, Suite 150 Union, NJ 07083	866-867-8328 908-638-6605 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 900A lake Street, Suite 2 Ramsey, NJ 07466	800-900-1982 www.constellation.com	**C/I** **ACTIVE**
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**

Core Energy Inc. 37 West 55th Street Suite 200 Ocean City, NJ 08226	877-329-3495 www.core-energy.net	**R/C** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	888-925-9115 www.directenergy.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route #70 West, Suite 125 Lakewood, NJ 08701	866-645-9802 www.dom.com/products	**R/C** **ACTIVE**
Energy Plus Natural Gas LP 309 Fellowship Road, East Gate Center, Suite 200 Mt. Laurel, NJ 08054	877-866-9193 www.energypluscompany.com	**R/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Greenlight Energy 330 Hudson Street, Suite 4 Hoboken, NJ 07030	718-204-7467 www.greenlightenergy.us	**C** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C** **ACTIVE**
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hess Small Business Services, LLC One Hess Plaza Woodbridge, NJ 07095	888-494-4377 www.hessenergy.com	**C/I** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, New Jersey 07102	973-438-4380 www.idtenergy.com	**R/C** **ACTIVE**

Integrys Energy Services-Natural Gas, LLC 99 Wood Avenue South Suite #802 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-927-9794 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons, Inc. **d/b/a Systrum Energy** 1 Bergen Blvd. Fairview, NJ 07022	1-877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	800-828-9427 www.metromediaenergy.com	**C** **ACTIVE**
MxEnergy, Inc. 900 Lake Street Ramsey, NJ 07446	800-785-4374 www.mxenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, NJ 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 3000 East Brunswick, NJ 08816	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Respond Power LLC 10 Recency CT Lakewood, NJ 08701	877-973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(973) 494-8097 www.streamenergy.net	**R/C** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	800-388-3862 www.lowcostpower.com	**R** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street, P.O. Box 777 Bridgeton, NJ 08302	856-455-1111 800-557-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
Xoom Energy New Jersey, LLC 744 Broad Street Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

Back to main supplier information page

APPENDIX B

Equipment Inventory

CHA Project # 28950
Morris County Vocational School District

Description	Building #	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	NJ Protocols life expectancy		
														Current year	Years Old	
RTU	6	1	CoolBreeze	CHCRUBFP-160-4-H1900-30	M4003-1284	Packaged Chiller/Free Cooling RTU with Hot Water Heating Coil	167 Tons/ 187.4 MBH	12 EER	Roof	Entire Building	2004	10		2014	10	20
Boilers	6	2	Raypack	H9-2342	406223426	Heating Hot Water Boiler	2,340 MBH Each	84%	Roof Penthouse	Heating System	2004	10		2014	10	20
HHW Pumps	6	2	B&G/US Electrical Motors	AY02	D10P2H	Heating Hot Water Pump	10 HP Each	90.20%	Roof Penthouse	Heating System	2004	10		2014	10	20
VAV Boxes	6	Unknown	Not Accessible	Various	Various	VAV Box with HW Reheat Coil	Various	NA	Various	Heating/Cooling System	2004	10		2014	10	20

Morris County Vocational Technical School LGEA - Building 6
CHA Project No. 28950
Existing Lighting & Audit Input

Cost of Electricity: **$0.090** **$/kWh**
$3.38 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	Notes
40LED	1st Floor Hall	Hallways	10	T 32 R F 2 (ELE)	F42LL	60	0.60	SW	2736	1,642	NONE	
254LED	1st Floor Hall	Hallways	20	CFQ26/2	CFQ26/2	66	1.32	SW	2736	3,612	NONE	
265LED	1st Floor Hall	Hallways	3	Gym HB 8L CFL	CF42/8-L	376	1.13	SW	2736	3,086	NONE	
218LED	601 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	601/602 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	602 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	603 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	603/604 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	604 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	605 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	605/606 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	606 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	607 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	607/608 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	608 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
40LED	Stairwell	Hallways	3	T 32 R F 2 (ELE)	F42LL	60	0.18	SW	2736	492	NONE	
117	Stairwell	Hallways	2	CF 23	CFS23/1	23	0.05	SW	2736	126	NONE	
254LED	2nd Floor Hall	Hallways	20	CFQ26/2	CFQ26/2	66	1.32	SW	2736	3,612	NONE	
265LED	2nd Floor Hall	Hallways	3	Gym HB 8L CFL	CF42/8-L	376	1.13	SW	2736	3,086	NONE	
40LED	2nd Floor Hall	Hallways	10	T 32 R F 2 (ELE)	F42LL	60	0.60	SW	2736	1,642	NONE	
40LED	2nd Floor Conference Room	Classrooms	5	T 32 R F 2 (ELE)	F42LL	60	0.30	SW	4480	1,344	C-OCC	
40LED	2nd Floor Mens Restroom	Classrooms	2	T 32 R F 2 (ELE)	F42LL	60	0.12	SW	4480	538	NONE	
218LED	611 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	611/612 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	612 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	613 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	613/614 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	614 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	615 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	615/616 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	616 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
218LED	617 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
55LED	617/618 Mid Room	Classrooms	3	2T 17 R F 3 (ELE)	F23ILL	47	0.14	SW	4480	632	NONE	
218LED	618 Classroom	Classrooms	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.35	SW	4480	6,048	C-OCC	
41LED	2nd Floor Storage	Storage Areas	1	W 32 R F 2 (MAG)	F42LL	94	0.09	SW	1000	94	NONE	
41LED	2nd Floor Roof Access	Storage Areas	1	W 32 R F 2 (MAG)	F42LL	94	0.09	SW	1000	94	NONE	
	Total		**344**				**29.66**			**121,188**		

APPENDIX C

ECM Calculations

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950

Rate of Discount (used for NPV) 3.0%

Utility Costs		Yearly Usage	Metric Ton Carbon Dioxide Equivalent	Building Area	Annual Utility Cost		
					Electric	Natural Gas	Fuel Oil
$ 0.120	$/kWh blended		0.000420205	39,845	$ 53,750	$ 27,853	$ -
$ 0.090	$/kWh supply	455,694	0.000420205				
$ 3.38	$/kW	168.6	0				
$ 1.13	$/Therm	24,730	0.00533471				
$ 9.00	$/kgals	3,000	0				
$ -	$/Gal	-					

Building 6

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	Equivalent CO_2 (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Install Condensing Boiler for Shoulder Months	0.0	0	2,982	0	0	3,357	$ 67,010	20.0	25	15.9	$ 2,625	N	19.2	0.0	0	74,545	0	$ 83,937	0.3	($5,921)	2.2%
Y	ECM-2	Install Heating Hot Water Pump VFDs & Premium Motors	10.3	18,820	0	0	0	2,258	$ 9,845	4.4	15.0	7.9	$ 3,208	N	2.9	154.5	282,302	0	0	$ 40,144	3.1	$20,324	33.6%
N	ECM-L1	Lighting Replacements / Upgrades	16.1	65,908	0	0	0	6,585	$ 104,759	15.9	15.0	27.7	$ 17,100	N	13.3	241.5	988,620	0	0	$ 128,430	0.2	($9,051)	1.5%
N	ECM-L2	Install Lighting Controls (Add Occupancy Sensors)	0.0	29,434	0	0	0	3,532	$ 4,590	1.3	15.0	12.4	$ 595	N	1.1	0.0	441,510	0	0	$ 52,981	10.5	$38,171	88.4%
Y	ECM-L3	Lighting Replacements with Controls (Occupancy Sensors)	16.1	79,066	0	0	0	7,769	$ 109,349	14.1	15.0	33.2	$ 17,695	N	11.8	241.5	1,185,990	0	0	$ 152,114	0.4	$1,091	3.2%
		Total (Not Including [B] Option ECMs or L1, L2)	**26.4**	**97,886**	**2,982**	**0**	**0**	**$ 13,385**	**$ 186,204**	**13.9**	**18.3**	**57**	**$ 23,528**		**12.2**	**396**	**1,468,292**	**74,545**	**-**	**$ 276,195**	**0.5**	**$21,413**	**4.5%**
		Recommended Measures (highlighted green above)	**26.4**	**97,886**	**2,982**	**0**	**0**	**$ 13,385**	**$ 186,204**	**13.9**	**18.3**	**57**	**$ 23,528**	**0**	**12.2**	**396**	**1,468,292**	**74,545**	**-**	**$ 276,195**	**0.5**	**$21,413**	**4.5%**
		% of Existing	**16%**	**21.48%**	**12.06%**	**0**	**0**																

	City:	Newark, NJ				
	Occupied Hours/Week	75	75	75	75	50
		Building Operating	Auditorium Occupied	Gymnasium Occupied	Library Occupied	Classrooms Occupied
Temp	Enthalpy h (Btu/lb)	Bin Hours	Hours	Hours	Hours	Hours	Hours
102.5							
97.5	35.4	6	3	3	3	3	2
92.5	37.4	31	14	14	14	14	9
87.5	35.0	131	58	58	58	58	39
82.5	33.0	500	223	223	223	223	149
77.5	31.5	620	277	277	277	277	185
72.5	29.9	664	296	296	296	296	198
67.5	27.2	854	381	381	381	381	254
62.5	24.0	927	414	414	414	414	276
57.5	20.3	600	268	268	268	268	179
52.5	18.2	730	326	326	326	326	217
47.5	16.0	491	219	219	219	219	146
42.5	14.5	656	293	293	293	293	195
37.5	12.5	1,023	457	457	457	457	304
32.5	10.5	734	328	328	328	328	218
27.5	8.7	334	149	149	149	149	99
22.5	7.0	252	113	113	113	113	75
17.5	5.4	125	56	56	56	56	37
12.5	3.7	47	21	21	21	21	14
7.5	2.1	34	15	15	15	15	10
2.5	1.3	1	0	0	0	0	0
-2.5							
-7.5							

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

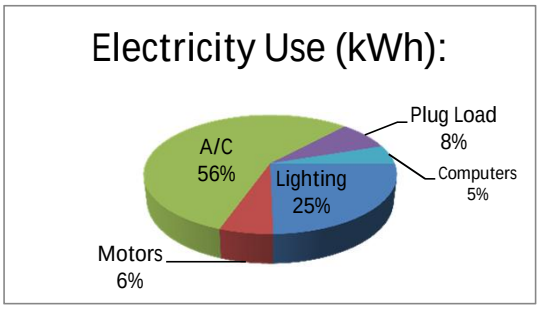
Heating System Efficiency	80%
Cooling Eff (kW/ton)	1.2

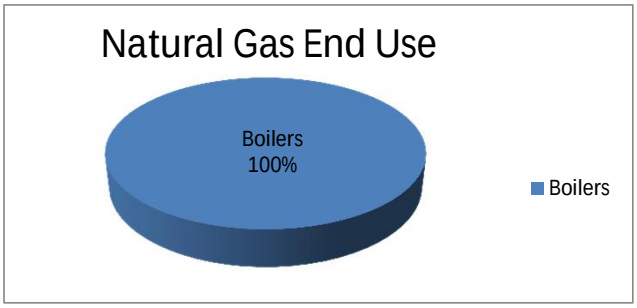
Heating		
Hours	4,427	Hrs
Weighted Avg	40	F
Avg	28	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
455,694	Total	Based on utility analysis	
121,188	Lighting	From Lighting Calculations	0.26594173
28,304	Motors	Estimated	0.062111242
277,312	A/C	Estimated	0.608548974
38,885	Plug Load	Estimated	0.08533084
25,200	Computers	Estimated	0.05530029
Natural Gas Use (Therms):		**Notes/Comments:**	
24,730	Total	Based on utility analysis	
24,730	Boilers	Therms/SF x Square Feet Served	1





Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

ECM-1: Install Boiler for Shoulder Month Operation

Description: This ECM evaluates the installation of a condensing boiler to supplement the existing standard efficiency boilers with one high efficiency condensing gas boiler. The existing boiler efficiency is 80% (per NJBPU protocols) and the proposed boiler efficiency is 90% (average seasonal efficiency). Electrical power consumption due to pumps is considered to be the same for both the proposed system and the baseline system.

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.13	/ Therm	Natural Gas
Baseline Fuel Cost		/ Gal	No. 2 Oil
FORMULA CONSTANTS			
Oversize Factor	0.8		
Hours per Day	24		
Design Outdoor Temp	14	F	
Infrared Conversion Factor	1.0		1.0 if Boiler, 0.8 if Infrared Heater
EXISTING			
Capacity	1,500,000	btu/hr	Based on existing boiler nameplate
Heating Combustion Efficiency	80%		
Heating Degree-Day	2,783	Degree-day	
Design Temperature Difference	56	F	
Fuel Conversion	100,000	btu/therm	
PROPOSED			
Capacity	1,500,000	btu/hr	
Efficiency	96%		
SAVINGS			
Fuel Savings	2,982	Therms	NJ Protocols Calculation
Fuel Cost Savings	$ 3,357		

Savings calculation formulas are taken from NJ Protocols document for Occupancy Controlled Thermostats

Algorithms

$$Gas\ Savings\ (Therms) = \frac{OF \times ((CAPY_{Bi} \times EFF_Q) - (CAPY_{Qi} \times EFF_B \times ICF)) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_B \times ICF \times EFF_Q}$$

Definition of Variables

OF = Oversize factor of standard boiler or furnace (OF=0.8)

$CAPY_{Bi}$ = Total input capacity of the baseline furnace, boiler or heater in Btu/hour

$CAPY_{Qi}$ = Total input capacity of the qualifying furnace, boiler or heater in Btu/hour

HDD_{mod} = HDD by zone and building type

24 = Hours/Day

ΔT = design temperature difference

HC_{fuel} = Conversion from Btu to therms of gas or gallons of oil or propane (100,000 btu/therm; 138,700 btu/gal of #2 oil; 92,000 btu/gal of propane)

EFF_Q = Efficiency of qualifying heater(s) (AFUE %)

EFF_B = Efficiency of baseline heaters (AFUE %)

ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for furnaces/boilers)[2]

Furnaces and Boilers

Component	Type	Value	Source
$AFUE_q$	Variable		Application
$AFUE_b$	Fixed	Furnaces: 78% Boilers: 80% Infrared: 78%	EPACT Standard for furnaces and boilers
$CAPY_{in}$	Variable		Application
ΔT	Variable	See Table Below	1
HDD_{mod}	Fixed	See Table Below	1

Sources:

1. KEMA, *Smartstart Program Protocol Review*. 2009.
2. http://www.spaceray.com/1_space-ray_faqs.php

Adjusted Heating Degree Days by Building Type

Building Type	Heating Energy Density (kBtu/sf)	Degree Day Adjustment Factor	Atlantic City (HDD)	Newark (HDD)	Philadelphia (HDD)	Monticello (HDD)
Education	29.5	0.55	2792	2783	2655	3886
Food Sales	35.6	0.66	3369	3359	3204	4689
Food Service	39.0	0.73	3691	3680	3510	5137
Health Care	53.6	1.00	5073	5057	4824	7060
Lodging	15.0	0.28	1420	1415	1350	1976
Retail	29.3	0.55	2773	2764	2637	3859
Office	28.1	0.52	2660	2651	2529	3701
Public Assembly	33.8	0.63	3199	3189	3042	4452
Public Order/Safety	24.1	0.45	2281	2274	2169	3174
Religious Worship	29.1	0.54	2754	2745	2619	3833
Service	47.8	0.89	4524	4510	4302	6296
Warehouse/Storage	20.2	0.38	1912	1906	1818	2661

Heating Degree Days and Outdoor Design Temperature by Zone

Weather Station	HDD	Outdoor Design Temperature (F)
Atlantic City	5073	13
Newark	5057	14
Philadelphia, PA	4824	15
Monticello, NY	7060	8

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1: Install Boiler for Shoulder Month Operation - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
1,500 MBH NG Condensing Boiler	1	EA	$ 27,500	$ 10,000		$ 28,243	$ 12,460	$ -	$ 40,703	Vendor Estimate
Flue Installation	1	EA	$1,500.0	$1,500.00		$ 1,541	$ 1,869	$ -	$ 3,410	Vendor Estimate
Pump	1	EA	$1,500.0	$1,000.00		$ 1,541	$ 1,246	$ -	$ 2,787	RS Means 2012
Controls	1	EA	$ 500.0	$1,000.00		$ 514	$ 1,246	$ -	$ 1,760	RS Means 2012
Miscellaneous Electrical	1	LS	$ 1,000	$ 500		$ 1,027	$ 623	$ -	$ 1,650	RS Means 2012
Miscellaneous HW Piping	1	LS	$ 2,000	$ 1,000		$ 2,054	$ 1,246	$ -	$ 3,300	RS Means 2012
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 53,608	Subtotal
$ 13,402	25% Contingency
$ 67,010	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

ECM-2: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives

Description: This ECM evaluates the energy (electrical) savings associated with replacing existing motors with high efficiency motors (based on ASHRAE 2010 NEMA ratings) and adding variable frequency drives to control motor speed based on actual load verses constant volume / constant flow.

Variable Inputs

Electric Rate	$0.12	**$/kWh**
Demand Rate	$0.09	**$/kW**

MOTOR SCHEDULE										Savings Factor		Existing Motor Energy		Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty	HP	Total HP	Upgrade Motor	Load Factor	Existing Motor Eff.	New Motor Eff.	Annual Hours	Demand Savings Factor	Energy Savings Factor	Demand Energy (kW)	Electrical Energy (kWh)	Demand Energy (kW)	Electrical Energy (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
HHW Pumps	CHW/HW	2	10.0	20.0	N	0.75	87.5%	90.5%	2,214	0.201	0.580	12.8	28,304	2.5	9,484	10.3	18,820
															Total:	10.3	18,820.2
																$ -	$ 2,258
																	$ 2,258

Savings calculation formulas are taken from NJ Protocols document for VFDs

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

ECM-2: Upgrade to Premium Efficiency Motors and Install Variable Speed Drives - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.00

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
10.0 HP VFD	2	ea	$ 2,021	$ 509	$ -	$ 4,152	$ 1,269	$ -	$ 5,421	RS Means 2012
10.0 HP Motor	2	ea	$ 646	$ 88	$ -	$ 1,326	$ 220	$ -	$ 1,546	RS Means 2012
Electrical - misc.	2	ls	$ 200	$ 200	$ -	$ 411	$ 498	$ -	$ 909	RS Means 2012

$ 7,876	Subtotal
$ 1,969	25% Contingency
$ 9,845	**Total**

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

Morris County Vocational Technical School District - LGEA
CHA Project Number: 28950
Building 6

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 100 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be met:

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- Scope includes more than one measure
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	39,845
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$53,750	$27,853
Existing Usage (from utility)	455,694	24,730
Proposed Savings	97,886	2,982
Existing Total MMBtus	4,028	
Proposed Savings MMBtus	632	
% Energy Reduction	**15.7%**	
Proposed Annual Savings	$13,238	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.09	$0.93
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.09	$0.93

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$5,000
Incentive #2	$9,150	$2,787	$11,938
Incentive #3	$9,150	$2,787	$11,938
Total All Incentives	**$18,300**	**$5,575**	**$28,875**

Total Project Cost	$186,204

		Allowable Incentive
% Incentives #1 of Utility Cost*	6.1%	$5,000
% Incentives #2 of Project Cost**	6.4%	$11,938
% Incentives #3 of Project Cost**	6.4%	$11,938
Total Eligible Incentives***	**$28,875**	
Project Cost w/ Incentives	$157,329	

Project Payback (years)	
w/o Incentives	w/ Incentives
14.1	11.9

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 25% of total project cost.
Maximum allowable amount of Incentive #3 is 25% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

Morris County Vocational Technical School LGEA - Building 6
CHA Project No. 28950
ECM-L1 Lighting Replacements

		EXISTING CONDITIONS								RETROFIT CONDITIONS							COST & SAVINGS ANALYSIS						
Field Code	Area Description Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of Fixtures No. of fixtures before the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Fixt No.)	Exist Control Pre-inst. control device	Annual Hours Estimated daily hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Number of Fixtures No. of fixtures after the retrofit	Standard Fixture Code "Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Fixture Code Code from Table of Standard Fixture Wattages	Watts per Fixture Value from Table of Standard Fixture Wattages	kW/Space (Watts/Fixt) * (Number of Fixtures)	Retrofit Control Retrofit control device	Annual Hours Estimated annual hours for the usage group	Annual kWh (kW/space) * (Annual Hours)	Annual kWh Saved (Original Annual kWh) - (Retrofit Annual kWh)	Annual kW Saved (Original Annual kW) - (Retrofit Annual kW)	Annual $ Saved (kWh Saved) * ($/kWh)	Retrofit Cost Cost for renovations to lighting system	NJ Smart Start Lighting Incentive Prescriptive Lighting Measures	Simple Payback With Out Incentive Length of time for renovations cost to be recovered	Simple Payback Length of time for renovations cost to be recovered
40LED	1st Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,642	10	T 38 R LED	RTLED38	38	0.4	SW	2,736	1,040	602	0.2	$ 63.10	$ 3,037.50	$500	48.1	40.2
254LED	1st Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,612	20	EVO35/10	EVO35/10	39	0.8	SW	2,736	2,134	1,477	0.5	$ 154.87	$ 8,775.00	$700	56.7	52.1
265LED	1st Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086	3	BAYLED78W	BAYLED78W	93	0.3	SW	2,736	763	2,323	0.8	$ 243.49	$ 2,532.59	$450	10.4	8.6
218LED	601 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	601/602 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	602 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	603 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	603/604 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	604 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	605 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	605/606 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	606 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	607 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	607/608 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	608 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
40LED	Stairwell	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2736	492	3	T 38 R LED	RTLED38	38	0.1	SW	2,736	312	181	0.1	$ 18.93	$ 911.25	$150	48.1	40.2
117	Stairwell	2	CF 23	CFS23/1	23	0.0	SW	2736	126	2	CF 23	CFS23/1	23	0.0	SW	2,736	126	-	0.0	$ -	$ -	$0		#DIV/0!
254LED	2nd Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,612	20	EVO35/10	EVO35/10	39	0.8	SW	2,736	2,134	1,477	0.5	$ 154.87	$ 8,775.00	$700	56.7	52.1
265LED	2nd Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086	3	BAYLED78W	BAYLED78W	93	0.3	SW	2,736	763	2,323	0.8	$ 243.49	$ 2,532.59	$450	10.4	8.6
40LED	2nd Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,642	10	T 38 R LED	RTLED38	38	0.4	SW	2,736	1,040	602	0.2	$ 63.10	$ 3,037.50	$500	48.1	40.2
40LED	2nd Floor Conference Room	5	T 32 R F 2 (ELE)	F42LL	60	0.3	SW	4480	1,344	5	T 38 R LED	RTLED38	38	0.2	SW	4,480	851	493	0.1	$ 48.81	$ 1,518.75	$250	31.1	26.0
40LED	2nd Floor Mens Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	4480	538	2	T 38 R LED	RTLED38	38	0.1	SW	4,480	340	197	0.0	$ 19.53	$ 607.50	$100	31.1	26.0
218LED	611 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	611/612 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	612 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	613 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	613/614 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	614 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	615 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	615/616 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	616 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
218LED	617 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
55LED	617/618 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	SW	4,480	336	296	0.1	$ 29.29	$ 607.50	$150	20.7	15.6
218LED	618 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	SW	4,480	2,688	3,360	0.8	$ 332.82	$ 4,225.50	$750	12.7	10.4
41LED	2nd Floor Storage	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94	1	STLED4	STLED4	40	0.0	SW	1,000	40	54	0.1	$ 7.05	$ 281.70	$50	40.0	32.9
41LED	2nd Floor Roof Access	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94	1	STLED4	STLED4	40	0.0	SW	1,000	40	54	0.1	$ 7.05	$ 281.70	$50	40.0	32.9
	Total	344				29.7			121,188	344			1,397	13.6			55,280	65,908	16.1	$6,584	$104,759	$17,100		
																		Demand Savings		16.1	$652			
																		kWh Savings		65,908	$5,932			
																		Total savings			$6,584		15.9	13.3

Morris County Vocational Technical School LGEA - Building 6

CHA Project No. 28950

ECM-L2 Install Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
40LED	1st Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,641.6	10	T 32 R F 2 (ELE)	F42LL	60	0.6	NONE	2736	1,641.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
254LED	1st Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,611.5	20	CFQ26/2	CFQ26/2	66	1.3	NONE	2736	3,611.5	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
265LED	1st Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086.2	3	Gym HB 8L CFL	CF42/8-L	376	1.1	NONE	2736	3,086.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	601 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	601/602 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	602 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	603 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	603/604 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	604 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	605 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	605/606 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	606 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	607 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	607/608 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	608 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
40LED	Stairwell	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2736	492.5	3	T 32 R F 2 (ELE)	F42LL	60	0.2	NONE	2736	492.5	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
117	Stairwell	2	CF 23	CFS23/1	23	0.0	SW	2736	125.9	2	CF 23	CFS23/1	23	0.0	NONE	2736	125.9	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
254LED	2nd Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,611.5	20	CFQ26/2	CFQ26/2	66	1.3	NONE	2736	3,611.5	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
265LED	2nd Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086.2	3	Gym HB 8L CFL	CF42/8-L	376	1.1	NONE	2736	3,086.2	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
40LED	2nd Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,641.6	10	T 32 R F 2 (ELE)	F42LL	60	0.6	NONE	2736	1,641.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
40LED	2nd Floor Conference Room	5	T 32 R F 2 (ELE)	F42LL	60	0.3	SW	4480	1,344.0	5	T 32 R F 2 (ELE)	F42LL	60	0.3	C-OCC	3136	940.8	403.2	0.0	$36.29	$270.00	$35.00	7.4	6.5
40LED	2nd Floor Mens Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	4480	537.6	2	T 32 R F 2 (ELE)	F42LL	60	0.1	NONE	4480	537.6	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	611 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	611/612 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	612 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	613 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	613/614 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	614 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	615 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	615/616 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	616 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
218LED	617 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
55LED	617/618 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	631.7	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	NONE	4480	631.7	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
218LED	618 Classroom	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048.0	15	W 32 P F 3 (ELE)	F43ILL/2	90	1.4	C-OCC	3136	4,233.6	1,814.4	0.0	$163.30	$270.00	$35.00	1.7	1.4
41LED	2nd Floor Storage	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94.0	1	W 32 R F 2 (MAG)	F42LL	94	0.1	NONE	1000	94.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
41LED	2nd Floor Roof Access	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94.0	1	W 32 R F 2 (MAG)	F42LL	94	0.1	NONE	1000	94.0	0.0	0.0	$0.00	$0.00	$0.00		#DIV/0!
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
															0	#N/A	#VALUE!	#VALUE!	#N/A	#VALUE!			#VALUE!	#VALUE!
	Total	**344**				**29.7**			**121188.0**	**344.0**				**29.7**				**91754.4**	**29433.6**	**0.0**	**2649.0**	**4590.0**	**595.0**		
																		Demand Savings			**0.0**	**$0**			
																		kWh Savings			**29,434**	**$3,532**			
																		Total Savings				**$3,532**		**1.3**	**1.1**

Morris County Vocational Technical School LGEA - Building 6
CHA Project No. 28950
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Smart Start Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	Lighting Fixture Code	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
40LED	1st Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,642	10	T 38 R LED	RTLED38	38	0.4	NONE	2,736	1,040	602	0.2	$ 63.10	$ 3,037.50	$ 500	48.1	40.2
254LED	1st Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,612	20	EVO35/10	EVO35/10	39	0.8	NONE	2,736	2,134	1,477	0.5	$ 154.87	$ 8,775.00	$ 700	56.7	52.1
265LED	1st Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086	3	BAYLED78W	BAYLED78W	93	0.3	NONE	2,736	763	2,323	0.8	$ 243.49	$ 2,532.59	$ 450	10.4	8.6
218LED	601 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	601/602 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	602 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	603 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	603/604 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	604 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	605 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	605/606 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	606 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	607 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	607/608 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	608 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
40LED	Stairwell	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2736	492	3	T 38 R LED	RTLED38	38	0.1	NONE	2,736	312	181	0.1	$ 18.93	$ 911.25	$ 150	48.1	40.2
117	Stairwell	2	CF 23	CFS23/1	23	0.0	SW	2736	126	2	CF 23	CFS23/1	23	0.0	NONE	2,736	126	-	0.0	$ -	$ -	$ -	-	-
254LED	2nd Floor Hall	20	CFQ26/2	CFQ26/2	66	1.3	SW	2736	3,612	20	EVO35/10	EVO35/10	39	0.8	NONE	2,736	2,134	1,477	0.5	$ 154.87	$ 8,775.00	$ 700	56.7	52.1
265LED	2nd Floor Hall	3	Gym HB 8L CFL	CF42/8-L	376	1.1	SW	2736	3,086	3	BAYLED78W	BAYLED78W	93	0.3	NONE	2,736	763	2,323	0.8	$ 243.49	$ 2,532.59	$ 450	10.4	8.6
40LED	2nd Floor Hall	10	T 32 R F 2 (ELE)	F42LL	60	0.6	SW	2736	1,642	10	T 38 R LED	RTLED38	38	0.4	NONE	2,736	1,040	602	0.2	$ 63.10	$ 3,037.50	$ 500	48.1	40.2
40LED	2nd Floor Conference Room	5	T 32 R F 2 (ELE)	F42LL	60	0.3	SW	4480	1,344	5	T 38 R LED	RTLED38	38	0.2	C-OCC	3,136	596	748	0.1	$ 71.80	$ 1,788.75	$ 285	24.9	20.9
40LED	2nd Floor Mens Restroom	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	4480	538	2	T 38 R LED	RTLED38	38	0.1	NONE	4,480	340	197	0.0	$ 19.53	$ 607.50	$ 100	31.1	26.0
218LED	611 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	611/612 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	612 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	613 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	613/614 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	614 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	615 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	615/616 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	616 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
218LED	617 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
55LED	617/618 Mid Room	3	2T 17 R F 3 (ELE)	F23ILL	47	0.1	SW	4480	632	3	2T 25 R LED	2RTLED	25	0.1	NONE	4,480	336	296	0.1	$ 29.29	$ 607.50	$ 150	20.7	15.6
218LED	618 Classroom	15	W 32 P T 3 (ELE)	F43ILL/2	90	1.4	SW	4480	6,048	15	STLED4	STLED4	40	0.6	C-OCC	3,136	1,882	4,166	0.8	$ 405.40	$ 4,495.50	$ 785	11.1	9.2
41LED	2nd Floor Storage	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94	1	STLED4	STLED4	40	0.0	NONE	1,000	40	54	0.1	$ 7.05	$ 281.70	$ 50	40.0	32.9
41LED	2nd Floor Roof Access	1	W 32 R F 2 (MAG)	F42LL	94	0.1	SW	1000	94	1	STLED4	STLED4	40	0.0	NONE	1,000	40	54	0.1	$ 7.05	$ 281.70	$ 50	40.0	32.9
															0	#N/A								#VALUE!
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S	Total	344				29.7			121,188	344				13.6			42,122		16.1	7,768	109,349	$17,695		
S																		Demand Savings		16.1	$652			
S																		kWh Savings		79,066	$7,116			
S																		Total Savings			$7,768		14.1	11.8

APPENDIX D

New Jersey Board of Public Utilities Incentives

i. **Smart Start**

ii. **Direct Install**

iii. **Pay for Performance (P4P)**

iv. **Energy Savings Improvement Plan (ESIP)**

I. SMART START

NJ SmartStart Buildings

Program Overview

With New Jersey SmartStart Buildings ...

... A smart start now means better performance later! Whether you're starting a commer industrial project from the ground up, renovating existing space, or upgrading equipmen unique opportunities to upgrade the energy efficiency of the project.

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

New Jersey SmartStart Buildings can provide a range of support — at no cost to you — substantial energy savings, both now and for the future. Learn more about:

- Project Categories
- Custom Measures
- Incentives for Qualifying Equipment and Projects
- Program Terms and Conditions
- Find a Trade Ally

Please note: pre-approval is required for almost all energy efficiency incentives. T you must submit an application form (and applicable worksheets) and receive an approv from the program before any equipment is installed (click here for complete Terms and (Upon receipt of an approval letter, you may proceed to install the equipment listed on yc approved application. Equipment installed prior to the date of the approval letter is not e an incentive. **Any customer and/or agent who purchases equipment prior to the re incentive approval letter does so at his/her own risk.**

Getting Started

Submit your project application form as soon as you know you will be doing a constructi or replacing/adding equipment.

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Apply for pre-approval by submitting an application for the type of equipment you have c install. The application should be accompanied by a related worksheet, where applicabl manufacturer's specification sheet (refer to the specific program requirements on the ba application for specs needed for your project) for the equipment you are planning to inst (Program representatives will review your application package and approve it, reject it, a advise you of upgrades in equipment that will save energy costs and/or increase your in

Support for Custom Energy-Efficiency Measures

Custom measures allows program participants the opportunity to receive an incentive fo energy-efficiency measures that are not on the prescriptive equipment Incentive list, but project/facility specific.

Incentives for Qualifying Equipment and Projects

Financial incentives are available for large and small projects. These incentives offset s maybe even all! — of the added cost to purchase qualifying energy-efficient equipment, provides significant long-term energy savings. Ranges of incentives are available for qu equipment (depending on type, size, and efficiency) in several categories.

Find out more about equipment incentives

For specific details on equipment requirements and financial incentives, including ince equipment not listed here, contact a program representative. Fiscal year financial incent be limited to a maximum of $500,000 per customer utility account and are available as f permits.

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COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

EQUIPMENT INCENTIVES

FOOD SERVICE EQUIPMENT

APPLICATION FORMS

TOOLS AND RESOURCES

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Home » Commercial & Industrial » Programs » NJ SmartStart Buildings

Equipment Incentives

Special Notice

Enhanced incentives are available for NJ SmartStart Building upgrades in buildings im Hurricane Sandy. Eligible projects receive an additional 50% and new incentives have added for high efficiency food service equipment.

Visit the Sandy web page for details and important links.

More reasons for a smart start on your next project!



New Jersey SmartStart Buildings provides **financial incentives for qualifying equipment**. These incentives were developed to help our customers offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings. A wide range of incentives are available for qualifying equipment (depending on type, size and efficiency).

Listed below are the types of qualifying equipment and ranges of incentives. For details on equipment requirements and full listings of incentives, refer to the **online application forms**.

Please note that almost all equipment incentives require pre-approval before equipment is installed. (**click for exceptions**)To start the pre-approval process, submit an Equipment Application, and appropriate Equipment Worksheets, for the type types of equipment you are planning to install along with equipment specification sheets (refer to the specific program requirements on the back of the application for specificatic needed for your project) and a current utility bill(s).

In order to be eligible to receive financial incentives under this Program, Applicants mus receive electric and/or gas service from one of the regulated electric and/or gas utilities the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

Electric Chillers

Water-cooled chillers ($12 - $170 per ton)
Air-cooled chillers ($8 - $52 per ton)

Gas Cooling

Gas absorption chillers ($185-$450 per ton)
Gas Engine-Driven Chillers (Calculated through Custom Measure F

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Desiccant Systems ($1.00 per cfm - gas or electric)

Electric Unitary HVAC

Unitary AC and split systems ($73 - $92 per ton)
Air-to-air heat pumps ($73 - $92 per ton)
Water-source heat pumps ($81 per ton)
Packaged terminal AC & HP ($65 per ton)
Central DX AC Systems ($40 - $72 per ton)
Dual Enthalpy Economizer Controls ($250)
Occupancy Controlled Thermostats ($75 each)
A/C Economizing Controls ($85 - $170 each)

Ground Source Heat Pumps

Closed Loop ($450-750 per ton)

Gas Heating

Gas-fired boilers < 300 MBH ($300 per unit)
Gas-fired boilers ≥ 300 MBH - 1500 MBH ($1.75 per MBH)
Gas-fired boilers ≥ 1500 MBH - ≤ 4000 MBH ($1.00 per MBH)
Gas-fired boilers > 4000 MBH (Calculated through Custom Measur
Gas furnaces ($300-$400 per unit)
Gas infrared heaters - indoor only ($300 - $500 per unit)
Boiler economizing controls ($1,200 - $2,700 per unit)

Variable Frequency Drives

Variable air volume ($65 - $155 per hp)
Chilled-water pumps ($60 per hp)
Compressors ($5,250 to $12,500 per drive)

Natural Gas Water Heating

Gas water heaters ≤ 50 gallons ($50 per unit)
Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Tankless water heaters replacing a free standing water heater > 82 energy factor ($300 per heater)
Gas-fired booster water heaters ($17 - $35 per MBH)

Premium Motors

Three-phase motors ($45 - $700 per motor) **(Incentive was discor effective March 1, 2013 except for buildings impacted by Hurri Sandy. Approved applications will have the standard timefram year from the program commitment date to complete the instal**

Refrigerator/Freezer Case Premium Efficiency Motors (ECM)

Fractional (< 1 HP) Electronic Commutated Motors (ECM) ($40 per for replacement of existing shaded-pole motor in refrigerated/freeze

Prescriptive Lighting

New Linear Fluorescent

- T-12, HID and Incandescent to T-5 and T-8 ($25 - $200 p fixture) **(Note: T12 replacements are only available for buildings impacted by Hurricane Sandy)**
- New Induction ($70 per replaced HID fixture)
- New LED
  - Screw-in/Plug-in ($10 - $20 per lamp)
  - Refrigerator/Freezer Case ($30 - $65 per fixture)
  - Outdoor pole/arm/wall-mounted luminaires ($100 - $175 p fixture)
  - Display case ($30 per case)
  - Shelf-mounted display and task ($15 per linear foot)
  - Wall-wash, desk, recessed ($20 - $35 per fixture)
  - Parking garage luminaires ($100 per fixture)
  - Track or Mono-Point directional ($50 per fixture)
  - Stairwell and Passageway luminaires ($40 per fixture)
  - High-Bay, Low-Bay ($150 per fixture)
  - Bollard ($50 per fixture)
  - luminaires for Ambient Lighting of Interior Commercial Spa *Linear panels ($50 per fixture)*
  - Fuel pump canopy ($100 per fixture)
  - LED retrofit kits (custom measures)
- New Pulse-Start Metal Hallide ($25 per fixture)
- Linear Fluorescent Retrofit ($10 - $20 per fixture)
- Induction Retrofit ($50 per retrofitted HID fixture)
- New Construction/Complete Renovation (performance-based)

Note: Incentives for T-12 to T-5 and T-8 lamps with electronic ballast in facilities ($10 per fixture, 1-4 lamps) and T-5/T-8 high bay fixtures ($16 - per fixture) were discontinued effective March 1, 2013 for T-12 retrofits replacements except for buildings impacted by Hurricane Sandy. Appr applications will have the standard timeframe of one year from the pro commitment date to complete the installation

Lighting Controls

- Occupancy Sensors
  - Wall mounted ($20 per control)
  - Remote mounted ($35 per control)
  - Daylight dimmers ($25 per fixture controlled, $50 per fixtu office applications only)
  - Occupancy controlled hi-low fluorescent controls ($25 per controlled)
- HID or Fluorescent Hi-Bay Controls
  - Occupancy hi-low ($35 per fixture controlled)
  - Daylight dimming ($45 per fixture controlled)

Refrigeration

- Covers and Doors
  - Energy-Efficient doors for open refrigerated doors/covers per door)
  - Aluminum Night Curtains for open refrigerated cases ($3.5 linear foot)
- Controls
  - Door Heater Control ($50 per control)
  - Electric Defrost Control ($50 per control)
  - Evaporator Fan Control ($75 per control)
  - Novelty Cooler Shutoff ($50 per control)

Food Service Equipment

Cooking
- Combination Electric Oven/Steamer ($1,000 per oven)
- Combination Gas Oven/Steamer ($750 per oven)
- Electric Convection Oven ($350 per oven)
- Gas Convection Oven ($500 per oven)
- Gas Rack Oven ($1,000 single, $2,000 double)
- Gas Conveyor Oven ($500 small deck, $750 large deck)
- Electric Fryer ($200 per vat)
- Gas Fryer ($749 per vat)
- Electric Large Vat Fryer ($200 per vat)
- Gas Large Vat Fryer ($500 per vat)
- Electric Griddle ($300 per griddle)
- Gas Griddle ($125 per griddle)
- Electric Steam Cooker ($1,250 per steamer)
- Gas Steam Cooker ($2,000 per steamer)

Holding
- Full Size Insulated Cabinets ($300 per cabinet)
- Three Quarter Size Insulated Cabinets ($250 per cabinet)
- Half Size Insulated Cabinets ($200 per cabinet)

Cooling
- Glass Door Refrigerators ($75 - $150 per unit)
- Solid Door Refrigerators ($50 - $200 per unit)
- Glass Door Freezers ($200 - $1,000 per unit)
- Solid Door Freezers ($100 - $600 per unit)
- Ice Machines ($50 - $500 per unit)

Cleaning
- Dishwashers ($400 - $1,500 per unit)

Other Equipment Incentives*

- Performance Lighting ($1.00 per watt per square foot below prograi incentive threshold, currently 5% more energy efficient than ASHR/ 2007 for New Construction only.)
- Custom electric and gas equipment incentives (not prescriptive)

*Equipment incentives are calculated based on type, efficiency, size, and ap and are evaluated on a case-by-case basis. Contact us for details.

II. DIRECT INSTALL

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

PARTICIPATION STEPS

PARTICIPATING CONTRACTORS

SUSTAINABLE JERSEY

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

Direct Install

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install

Let us pay up to 70% of your energy efficiency upgrade.

Sometimes, the biggest challenge to improving energy efficiency is knowing where t and how to get through the process. Created specifically for existing small to mediun facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgr high efficiency equipment. Direct Install is designed to cut your facility's energy costs replacing lighting, HVAC and other outdated operational equipment with energy effic alternatives. The program pays up to 70% of retrofit costs, dramatically improving yo payback on the project. There is a $125,000 incentive cap on each project.

ELIGIBILITY



Existing small to mid-sized commercial and industrial f with a peak electric demand that did not exceed 200 k any of the preceding 12 months are eligible to participa Direct Install. Applicants will submit the last 12 months electric utility bills indicating that they are below the de threshold and have occupied the building during that ti Buildings must be located in New Jersey and served b the state's public, regulated electric or natural gas utilit companies.

SYSTEMS & EQUIPMENT ADDRESSED BY THE PROGRAM

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Refrigeration
- Motors
- Natural Gas
- Variable Frequency Drives



Measures eligible for Direct Install are limited to specific equipment categories, type capacities. Boilers may not exceed 500,000 Btuh and furnaces may not exceed 140,

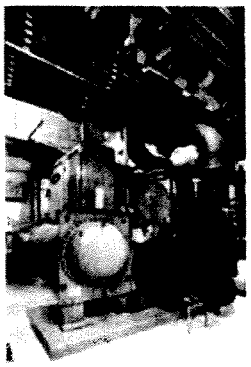
III. PAY FOR PERFORMANCE (P4P)

Pay for Performance - Existing Buildings

Download program applications and incentive forms.

The Greater the Savings, the Greater Your Incentives

Take a comprehensive, whole-building approach to saving energy in your existing facilit earn incentives that are directly linked to your savings. Pay for Performance relies on a program partners who provide technical services under direct you. Acting as your energy expert, your partner will develop a reduction plan for each project with a whole-building technica component of a traditional energy audit, a financial plan for fu energy efficient measures and a construction schedule for ins



Eligibility

Existing commercial, industrial and institutional buildings with demand over 100 kW for any of the preceding twelve months to participate including hotels and casinos, large office buildir family buildings, supermarkets, manufacturing facilities, scho shopping malls and restaurants. Buildings that fall into the fol customer classes are not required to meet the 100 kW dema to participate in the program: hospitals, public colleges and universities, 501(c)(3) non-p affordable multifamily housing, and local governmental entities. Your energy reduction p define a comprehensive package of measures capable of reducing the existing energy consumption of your building by 15% or more.

Exceptions to the 15% threshold requirement may be made for certain industrial, manuf water treatment and datacenter building types whose annual energy consumption is hea weighted on process loads. Details are available in the high energy intensity section of t page.

ENERGY STAR Portfolio Manager

Pay for Performance takes advantage of the ENERGY STAR Program with Portfolio Manager, EPA's interactive tool that allows facility managers to track and evaluate energy and water consumption across all of their buildings. The tool provides the opportunity to load in the characteristics and energy usage of your buildings and determine an energy performance benchmark score. You can then assess energy management goals over time, identify strategic opportunities for savings, and receive EPA recognition for superior energy performance.

This rating system assesses building performance by tracking and scoring energy use ir facilities and comparing it to similar buildings. That can be a big help in locating opportu cost-justified energy efficiency upgrades. And, based on our findings, you may be invite participate in the Building Performance with ENERGY STAR initiative and receive speci recognition as an industry leader in energy efficiency.

Incentives

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

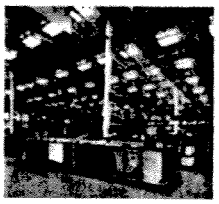
TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Pay for Performance incentives are awarded upon the satisfactory completion of three p milestones:

Incentive #1 - Submittal of complete energy reduction plan prepared by an app program partner - Contingent on moving forward, incentives will be between $5 $50,000 based on approximately $.10 per square foot, not to exceed 50% of th annual energy expense.



Incentive #2 - Installation of recommended measures - Incentives are based on the projected level of electricity and natural gas savings resulting from the installation of comprehensive energy-efficiency measures.

Incentive #3 - Completion of Post-Construction Benchmarking Report - A completed report verifying energy reductions based on one year of post-implementation results. Incentives for electricity and natural gas savings will be based on actual savings, provided that the minimum performance threshold of savings has been achieved.

A detailed Incentive Structure document is available on the applications and form

Steps to Participation

Click here for a step-by-step description of the program.

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New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com

BPU New Jersey Board of Public Utilities

PAY FOR PERFORMANCE APPLICATION FORM

July 1, 2014 – June 30, 2015

Utility Serving Applicant: ☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G
☐ New Jersey Natural Gas ☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas
☐ Other Electric Service Provider (please specify): _____
☐ Other Fuel Provider: _____ ☐ Oil: _____ ☐ Other (Please specify): _____

Instructions

1. Read the program material to determine project qualification.
2. Read the Participation Agreement and sign where indicated.
3. Fill out all applicable spaces on this form.
4. Provide a copy of the customer's company W-9 form.
5. Provide the most recent consecutive 12 month period of utility bills for the project for all accounts, organized in chronological order and separated by account. Utilize Utility Tool for applications with multiple accounts to organize data.
6. Provide brief description of facility, noting any special or unusual circumstances and/or site conditions.
7. Partner must submit the application package via e-mail, mail or fax DIRECTLY to the Market Manager – see back of this form.

Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

Customer/Owner Information (payment will be made to entity entered here)

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone/Fax	E-mail	Federal ID/SSN	

Partner Information

Company Name		Project Contact/Title	
Company Address	City	State	Zip
Phone	Fax	E-mail	

Project Information

Project Name			
Building Address	City	State	Zip
Utility Account Number(s): Electric		Gas	
* Note: Please use the back of this page for additional utility accounts if quantity exceeds space allotment.			
Annual Peak kW Demand	Building Type		Number of Buildings
Size of Building(s) (gross sq/ft)	Direct, Master or Sub Metered		

Funding

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

Do you expect to receive funding under any other efficiency programs? ☐ No ☐ Yes If Yes, please specify below:

Utility Program #1 – Utility: _____ Program Name: _____
Utility Program #2 – Utility: _____ Program Name: _____
Federal Program #1 – Organization: _____ Program Name: _____
Federal Program #2 – Organization: _____ Program Name: _____
Other Program – Organization: _____ Program Name: _____

Additional Project information

Additional Utility Account(s)

Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number
Account type	Account number

Additional Comments:

Complete this application form and send it directly to the Commercial/Industrial Market Manager by e-mail, mail or fax.

New Jersey's Clean Energy Program
c/o TRC Energy Services-P4P
900 Route 9 North, Suite 404 • Woodbridge, NJ 07095

Phone: 866-657-6278 • Fax: 732-855-0422
E-mail: P4P@NJCleanEnergy.com

Visit our website: NJCleanEnergy.com/P4P

New Jersey SmartStart Buildings® is a registered trademark. Use of the mark without the permission of the New Jersey Board of Public Utilities, Office of Clean Energy is prohibited.
*Incentives/Requirements subject to change.

Pay For Performance-Existing Buildings

Participation Agreement

Definitions:

ADMINISTRATOR – New Jersey Board of Public Utilities (NJBPU)

APPLICATION PROCESS – The Program pays incentives in phases upon satisfactory completion of each of three Program milestones - approval of a complete Energy Reduction Plan, installation of all recommended measures per the Energy Reduction Plan, completion of Post-Construction Benchmarking Report (for incentive amounts, please refer to Incentive Amounts). In order to be eligible for Program Incentives,a Participating Customer or an agent authorized by a Customer, must submit to the Market Manager a properly completed application package – application form, Participating Customer's company W-9, twelve consecutive months of the project's utility bills and executed Participation Agreement. All components of the application package must be filled out completely, truthfully and accurately. This application package must be received on or before June 30, 2015 in order to be eligible for the Fiscal Year 2015 Incentives. The Market Manager will review the application package to determine if the project is eligible for a Program Incentive. When approved, the Participating Customer will receive an approval letter from their Case Manager with the estimated authorized first incentive amount and the date by which the Energy Reduction Plan must be submitted. Upon receipt of the approval letter, the Participating Customer and Partner may proceed with work on the Energy Reduction Plan. The Market Manager or agent thereof reserves the right to conduct a pre-inspection of the facility prior to the installation of equipment. This will be done prior to the issuance of the Energy Reduction Plan approval letter. Approval of this Application is not an approval of the project's scope of work. Scope of work is only approved upon approval of the Energy Reduction Plan. See application and program guidelines for more information.

CHANGES TO THE PROGRAM – The Program and Participation Agreements may be changed by the Market Manager at any time without notice. Approved applications, however, will be processed to completion under the agreements in effect at the time of the Market Manager's approval.

ELIGIBILITY - Program Incentives are available to existing commercial, industrial and certain multifamily buildings with peak kilowatt demand usage of more than 100 kW in any of the most recent preceding twelve months of utility bills and a customer of the New Jersey Utilities. Market Manager has the discretion to approve applications that fall below the 100 kW minimum by no more than 10%. If the Participant is a municipal electric company customer, and a customer of an investor-owned gas New Jersey Utility, only gas measures will be eligible for incentives under the Program. Similarly, if the Participant is an oil/propane customer and a customer of an investor-owned electric New Jersey Utility, only electricity measures will be eligible for incentives under the Program.

Equipment procured by participating Customer through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program. Customers who, from July 1, 2013 – June 30, 2014, have not contributed to the Societal benefits Charge of the applicable New Jersey Utility may not be eligible for incentives offered through this program.

ENDORSEMENT – The Market Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design in promoting this Program.

ENERGY-EFFICIENT MEASURES – Any device eligible to receive a Program Incentive payment through the New Jersey's Clean Energy Commercial and Industrial Program. The total package of measures as presented in the Energy Reduction Plan must have at least a 10% internal rate of return (IRR).

ENERGY REDUCTION PLAN – A document created by the Participating Customer's selected Partner that defines several key aspects of the project including (but not limited to) existing conditions as a result of a whole-building technical analysis, benchmarking summaries, recommended measures, financing plan and implementation schedule.

ENERGY REDUCTION PLAN APPROVAL – After application approval, the Participating Customer and Partner must work together to finalize and submit an Energy Reduction Plan which incorporates a work scope that will achieve the minimum 15% reduction in source energy performance target in accordance with the Program rules and policies along with the Benchmarking Tool, modeling software file, a copy of the executed Partner and Participating Customer contract, an original copy of the executed Installation Agreement and a Request for Incentive #1 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. The Market Manager, agents thereof and/or the selected Partner must be provided reasonable access to the Participating Customer's facility, staff, tenants and/or others necessary to develop an Energy Reduction Plan that will achieve the minimum 15% performance target as well as the necessary utility billing data as dictated by the Program. The Energy Reduction Plan submittal package will be reviewed and must be approved by the Market Manager prior to payment of Incentive #1. Upon approval of the submittal package, the Customer will receive an Incentive #1 approval letter indicating the date by which all measures in the Energy Reduction Plan must be installed (no later than twelve months following the Energy Reduction Plan submittal approval date).

INCENTIVE AMOUNTS – Incentive #1 - $0.10 per square foot of the project with a maximum amount of $50,000 and minimum of $5,000, not to exceed 50% of the project's annual energy cost and contingent on installation of measures in the Energy Reduction Plan and receipt of a signed Installation Agreement. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Incentive #2 – 50% of the total performance-based incentive (combination of Incentives #2 and #3) calculated per Program's incentive structure; Incentive #3 – remaining amount based on the realized energy savings of the project. For customers that have successfully participated in the Local Government Energy Audit Program, Incentive #1 will be reduced by 50% to $0.05 per square foot up to $25,000. Actual Incentive #1 paid shall not be higher than 5% over the committed amount. Actual Incentive #2 paid shall not be higher than the committed amount, unless the Energy Reduction Plan has been resubmitted due to changes in the work scope. Actual Incentive #3 paid shall be higher or lower than the committed amount based on actual energy savings but shall not be greater than program Incentive Caps.

The Market Manager will provide incentives according to those described in this section or as modified upon notice to Participating Customer. All incentive payments are paid directly to the Participating Customer or the Participating Customer's designee as indicated on the application form. The Program is not bound to pay any incentive unless the submittal package associated with the incentive payment is approved by the Market Manager who reserves the sole discretion of approving or disapproving the submittal packages.

INCENTIVE CAP – Program Incentives #2 and #3 will be capped not to exceed 50% of the total actual project cost. Incentive #1 will be capped not to exceed 50% of the project's annual energy cost. The Market Manager reserves the right to limit the amount of the Program Incentives (Incentive #1, #2 and #3) to $1M per gas and electric account (limited to $2M per project) in a program year. Campus style facilities, which are mastered-metered, are subject to the annual incentive cap of $1 million per gas and electric account. The Participating Customer will also be subject to an annual Entity Cap of $4M (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

INSTALLATION AGREEMENT – The Participating Customer must submit an executed Installation Agreement as part of the Request for Incentive #1 Form. By executing the Installation Agreement, the Customer agrees to install all of the measures in the Energy Reduction Plan, which are estimated to result in meeting or exceeding the minimum 15% performance target. The Customer agrees to the performance-based incentives (Incentives #2 & #3) as indicated in the document which are based on the results of the Energy Reduction Plan. Implementation of the measures must commence in the time period twelve months following the approval date of the Energy Reduction Plan. Failure to complete the installation of the measures in the Energy Reduction Plan may result in the repayment of Incentive #1. In the event the project is cancelled and Incentive #1 is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid.

LIMITATION OF LIABILITY – By virtue of participating in this Program, Participating Customers agree to waive any and all claims or damages against TRC Energy Services, the Market Manager, and the Administrator, except the receipt of the Program Incentive. Participating Customers agree that the Market Manager's and Administrator's liability, in connection with this Program, is limited to paying the Program Incentive specified. Under no circumstances shall the Market Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Market Manager under this Program shall be individual, and not joint and/or several.

The Market Manager's review and approval of the Energy Reduction Plan cannot be construed to be a determination as to performance, applicability, dollar savings, energy savings, or any other aspect of the proposed project. The Market Manager and Administrator offer no guarantee or warranty of performance of the project's equipment or system. The participant assumes full responsibility and liability for the installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance and financing. By participating in the program and accepting incentive dollars, you agree to hold harmless the Market Manager and Administrator and their respective staffs with respect to the Project

MARKET MANAGER – TRC Energy Services is responsible for managing the New Jersey Clean Energy Commercial & Industrial Programs.

MEASUREMENT & VERIFICATION APPROVAL – Twelve months subsequent to the Incentive #2 Payment Submittal package submission date, measurement and verification of the projected energy reduction will be conducted by the Participating Customer's Partner using the project's post-installation utility data (supplied by the Customer). The Participating Customer must work with their Partner to submit the Incentive #3 Payment Submittal, consisting of the Post-Construction Benchmarking Pay For Performance-Existing Buildings Report, Benchmarking Tool, and Request for Incentive #3 form. All components of the submittal package must be filled out

completely, truthfully and accurately. Upon review of the submittal package (by the Market Manager or agent thereof), the remaining 50% of the total performance-based incentive (Incentives #2 & #3) will be released to the Participating Customer. If the Post-Construction Benchmarking Report indicates that the project did not meet the minimum performance target, the post-installation completion period may be extended to up to twenty-four months subsequent to the Incentive Payment #2 package submission date. Upon approval of the submittal package, the Customer will receive an Incentive #3 Submittal approval letter indicating successful completion of the program.

NEW JERSEY UTILITIES – The investor-owned electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CUSTOMERS – Those non-residential electric and/or gas service customers of the New Jersey Utilities who participate in this Program.

PARTICIPATING CUSTOMER'S CERTIFICATION – Participating Customer agrees that all information is true and that he/she has conformed to all of the Program and equipment requirements per the Program Guidelines. Participating Customer certifies that he/she purchased and installed the equipment listed in the Energy Reduction Plan at their defined New Jersey project location.

PARTNER– An approved professional who provides technical building performance services to Participating Customers, acting as their "energy efficiency expert". Participating Customers are required to hire an approved Pay for Performance Partner to develop the Energy Reduction Plan and facilitate installation of the recommended package of Energy-Efficient Measures. Participants are required to enter into a contractual agreement with a selected Partner which outlines the set of minimum services the Partner will provide to the Participating Customer throughout the life of the project. It is strongly recommended that Participating Customers perform due diligence in selecting a Pay for Performance Partner. Fees charged by the Partner are not regulated by the Program and could vary between Partners.

PERFORMANCE-BASED INCENTIVES – The combination of Incentives #2 and #3, which are based on the projected and actual energy reduction performance of the project.

PERFORMANCE TARGET – A minimum of a 15% annual source energy savings performance target must be achieved in order to participate. The performance target is based on reducing the total energy consumption for the facility. No more than 50% of the total source energy savings may be derived from lighting measures. The total energy savings may not come from a single measure. A 4% performance target may be offered to customers whose annual energy consumption is heavily weighted to manufacturing and process loads. This approach will be reviewed on a case-by-case basis and must be pre-approved by the Market Manager. In order to be considered, the project must involve: A manufacturing facility, including such industries as plastics and packaging, chemicals, petrochemicals, metals, paper and pulp, transportation, biotechnology, pharmaceutical, food and beverage, mining and mineral processing, general manufacturing, equipment manufacturers and data centers; and manufacturing and/or process-related loads, including data center consumption, consume 50% or more of total facility energy consumption. No more than 50% of the total source energy savings may be derived from non-investor owned utilities or fuels.

POST-INSTALLATION APPROVAL – After the complete installation of all measures in the Energy Reduction Plan, the Customer and their Partner must finalize and submit the Incentive #2 Payment Submittal, consisting of the Installation Report, invoices, and Request for Incentive #2 Payment form. All components of the submittal package must be filled out completely, truthfully and accurately. Upon review of the submittal package and verification of the complete installation of all measures in the Energy Reduction Plan (via inspection by the Market Manager or agent thereof), 50% of the total performancebased incentive (Incentives #2 & #3) will be released to the Participating Customer. Upon approval of the submittal package, the Customer will receive an Incentive #2 approval letter indicating the date by which the post-installation Measurement & Verification phase began and will end (twelve months in length).

The Market Manager reserves the right to verify sales transactions and to have reasonable access to Participating Customer's facility to inspect both pre-existing products or equipment (if applicable) and the Energy-Efficient Measures installed under this Program, either prior to issuing incentives or at a later time. Energy-Efficient Measures must be installed in buildings located within the service territory of one of the New Jersey Utilities (as defined by the Program) as designated on the Participating Customer's Pay for Performance application. Program Incentives are available for qualified Energy-Efficient Measures as listed and described in the Program Guidelines. The Participating Customer must ultimately own the equipment, either through an up-front purchase or at the end of a short-term lease.

PRE-INSTALLED MEASURES - An Energy Reduction Plan must be approved by the program and an approval letter sent to the customer in order for incentives to be committed. Upon receipt of an Energy Reduction Plan, all project facilities must be preinspected. Measures installed prior to pre-inspection of the facility shall not be included as part of the ERP scope of work and will not be eligible for incentives. Measure installation undertaken prior to ERP approval, but after pre-inspection, is done at the customer's own risk. In the event that an Energy Reduction Plan is rejected by the program, the customer will not receive any incentives.

PRODUCT INSTALLATION OR EQUIPMENT INSTALLATION – Installation of the Energy-Efficient Measures.

Projects with a contract threshold of $15,444 are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

PROGRAM – New Jersey's Clean Energy Pay for Performance Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq.

PROGRAM GUIDELINES – See Pay for Performance Program Guidelines available from your Partner.

PROGRAM INCENTIVES – Refers to the amount or level of incentive that the Program provides to participating customers pursuant to the Program offered herein (see the description under "Incentive Amount" heading).

PROGRAM OFFER – The Program covers products purchased and/or services rendered on or after July 1, 2014. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

PROJECT – A commercial, industrial or multifamily existing building with peak demand in excess of 100 kW in any of the most recent preceding twelve months of electric usage. Multifamily building(s) must be four (4) stories or greater or three (3) stories and under having central heating, cooling, or metering serving more than one building. The 100 kW requirement is waived for the following customer classes: hospitals, non-profits (as defined by section 501(c)(3) of the Internal Revenue Code), public colleges and universities, local government entities, including K-12 schools, and affordable multifamily customers (defined as low income, subsidized, HUD, etc.)

TAX CLEARANCE CERTIFICATION – Businesses must apply for and receive a Tax Clearance Certificate from the New Jersey Division of Taxation before they can receive any incentive, grant or other financial assistance from the Program.

TAX LIABILITY – The Market Manager will not be responsible for any tax liability that may be imposed on any Participating Customer as a result of the payment of Program Incentives. All Participating Customers must supply their federal tax identification number or social security number on the application form in addition to providing a copy of their W-9 form as part of the application package in order to receive a Program Incentive.

TERMINATION – New Jersey's Clean Energy Program reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this Program without prior or further notice.

WARRANTIES – THE MARKET MANAGER AND ADMINISTRATOR DO NOT WARRANT THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM, EITHER EXPRESSLY OR IMPLICITY. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES PROVIDED BY A MANUFACTURER OR VENDOR. CONTACT YOUR VENDOR/ SERVICES PROVIDER FOR DETAILS REGARDING PERFORMANCE AND WARRANTIES.

ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive program. I certify that all information provided is correct to the best of my knowledge, and I give the Market Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate the Pay For Performance Program, including the release of electric and natural gas utility billing information, as well as make available to the public non-sensitive information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for incentives under the guidelines of New Jersey's Clean Energy Program. This arrangement supersedes all other communications and representations.

CUSTOMER'S SIGNATURE
PARTNER SIGNATURE
By signing, I certify that I have read, understand and agree to the Participation Agreement listed above.

IV. ENERGY SAVINGS IMPROVEMENT PLAN (ESIP)

COMMERCIAL, INDUSTRIAL AND LOCAL GOVERNMENT

HURRICANE SANDY

PROGRAMS

NJ SMARTSTART BUILDINGS

PAY FOR PERFORMANCE

COMBINED HEAT & POWER AND FUEL CELLS

LOCAL GOVERNMENT ENERGY AUDIT

LARGE ENERGY USERS PROGRAM

ENERGY SAVINGS IMPROVEMENT PROGRAM

DIRECT INSTALL

ENERGY BENCHMARKING

OIL, PROPANE & MUNICIPAL ELECTRIC CUSTOMERS

EDA PROGRAMS

SBC CREDIT PROGRAM

PAST PROGRAMS

TOOLS AND RESOURCES

PROGRAM UPDATES

CONTACT US

Home » Commercial & Industrial » Programs

Energy Savings Improvement Program

A new State law allows government agencies to make energy related improvements to t facilities and pay for the costs using the value of energy savings that result from the imp Under Chapter 4 of the Laws of 2009 (the law), the "Energy Savings Improvement Program" (ESIP), provides all government agencies in New Jersey with a flexible tool to and reduce energy usage with minimal expenditure of new financial resources.

This Local Finance Notice outlines how local governments can develop and implement a their facilities. Below are two sample RFPs:

Local Government
School Districts (K-12)

All RFPs must be submitted to the Board for approval at ESIP@bpu.state.nj.us.

The Board also adopted protocols to measure energy savings:

Measuring Energy Savings
Procedures for Implementation

The ESIP approach may not be appropriate for all energy conservation and energy effic improvements. Local units should carefully consider all alternatives to develop an appro best meets their needs. Local units considering an ESIP should carefully review the Loc Notice, the law, and consult with qualified professionals to determine how they should a task.

The NJ Board of Public Utilities sponsored Sustainable Jersey in the creation of an ESIF Guidebook that explains how to implement the program. The guidebook also includes ca of successful projects and a list of helpful resources.

FIRST STEP – ENERGY AUDIT

For local governments interested in pursuing an ESIP, the first step is to perform an ene as prescribed in P.L.2012 c.55.

ENERGY REDUCTION PLANS

If you have an ESIP plan that needs to be submitted to the Board of Public Utilities, plea to ESIP@bpu.state.nj.us. Please limit the file size to 3MB (or break it into smaller files).

Frankford Township School District
Northern Hunterdon-Voorhees Regional High School
Manalapan Township *(**180 MB** - Right Click, Save As)*

ESIP PROGRAM

Final version 42413

BPU RULES

1. Public Entity must decide if they will use an ESCO or DIY method or Hybrid thereof prior to issuing the RFP and the RFP must state the intended method. A change in the project procurement model after the RFP closing date will be cause for immediate rejection and disqualification of potential Clean Energy program incentives.

2. RFP procedures shall be adhered to as per the legislation, including the use of BPU approved forms. Any alteration of the forms, without prior approval from the BPU shall be grounds for rejection.

3. RFP must include copy of an audit (ASHRAE Level II w/Level III for lighting) and audit must be prepared by a firm classified by DPMC in the 036 discipline.

4. All firms, including professional services, whether using ESCO or DIY model, must be DPMC classified.

5. If an Architect is engaged by the public entity, the architectural fees are the responsibility of the public entity and must be paid directly to the firm. These fees may be included in the energy cost savings analysis and payback.

   ESCO's may contract directly with an architectural firm, in which case the architectural firm serves as a subcontractor to the ESCO and the project related service costs may be included within the project's economic model.

6. Public entity shall conduct pre-bid meetings and site visits per existing statutes.

   In the interest of open public bidding transparency, it is a requirement of the BPU that all proposers must attend the pre-proposal bid meeting.

7. There shall be no negative cash flow in any year of the program.
   section 7 (1)(a)
   > "the energy savings resulting from the program will be sufficient to cover the cost of the program's energy conservation measures."

8. SREC values are not permitted to be used in the energy cost savings calculations.

9. Capital cost avoidance values are not to be used in the energy savings calculations.

10. Operational and Maintenance (O&M) cost savings may be permitted in the cost savings calculations, but only with supporting documentation.

11. Blended utility rates shall not be permitted. Use the actual utility tariff or local contracted rates if there is a third party supplier.

    For the RFP proposals, the public entity shall define the utility rates in the RFP

12. Contracted third party utility rates may only be used for the term of the contract (5 yr. maximum) Subsequent years are to be projected at the utility tariff rates plus the annual BPU escalation rates.

13. Public entity shall conduct M&V (measurement and verification) at the one (1) year operational date and shall provide a copy of the M&V report to the Board of Public Utilities.

    For the RFP proposals, the ESCO shall provide the cost for the one (1) year M&V only. For comparative purposes, the one year M&V pricing shall be indicated on the proposal Form VI, under the "Annual Service Costs" column. Additional M&V costs are at the discretion of the local unit and are not to be included in the proposal.

14. The decisions made by BPU staff regarding compliance or other issues that arise in connection with the RFP procurement process shall be considered a final decision of the BPU. Any appeal will need to be through the New Jersey Superior Court, Appellate Division.

15. For the RFP proposals only, Demand Response (DR) revenues claimed by ESCO's can only be projected for a maximum period of three (3) years. DR revenue projections beyond three years will not be permitted. DR revenues must be included and presented under the "Energy Rebates/Incentives" column of FORM VI.

16. ESCO "fees" proposed during the RFP phase of the project cannot increase post-award. ESCO's are required to maintain the fee percentages through final contract negotiations and construction of the Board approved Energy Savings Plan

17. Public Bid openings shall be held on the due date of the proposal submissions. The public entity shall announce the name of the bidder and the total dollar amount. After award of a contract, all proposals received will be made available by the owner for public inspection

18. Rejection of bids by the public entity shall be conducted in accordance with the appropriate sections of the applicable legislation, as stated in Title 40A:11-13.2. Additionally all proposals must be returned to the respective ESCO's upon rejection.

19. Field changes that exceed 5% of the project cost require BPU approval.

20. Energy Savings Plans (ESP) that is dependent upon incentives from the Clean Energy Program must review the current program requirements, at the time of application, for each incentive to insure eligibility. If any program incentive is denied, resubmission of all ESIP related forms will be necessary to remain ESIP qualified.

APPENDIX E

Photovoltaic Analysis

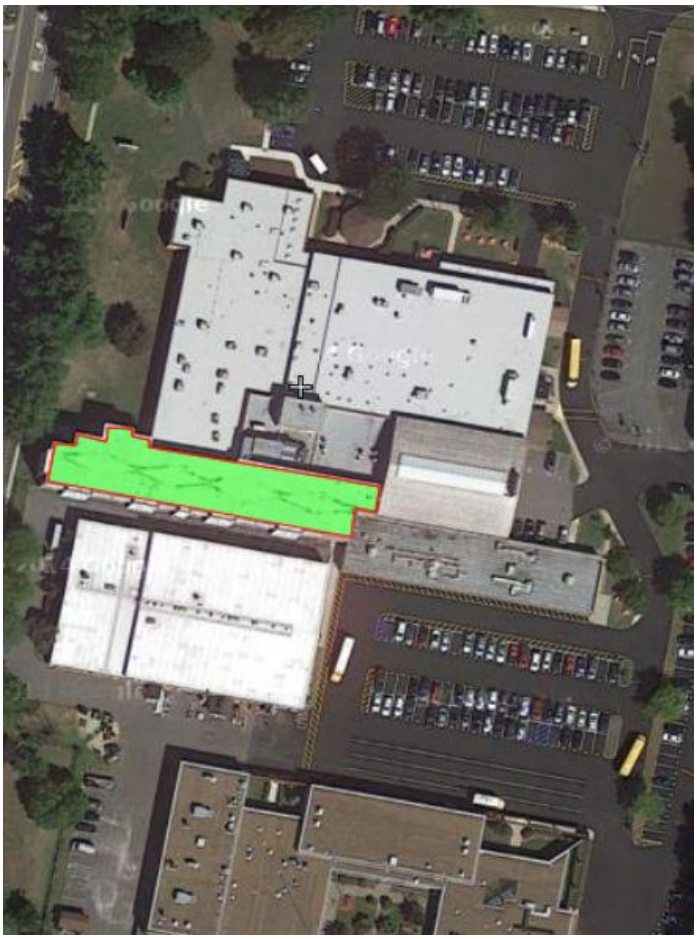
Morris County Vocational School District
Building 6

Cost of Electricity	$0.120	/kWh
Electricity Usage	322,452	kWh/yr
System Unit Cost	$4,000	/kW

Photovoltaic (PV) Solar Power Generation - Screening Assessment

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	Federal Tax Credit	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$120,000	**30.0**	**49,475**	**0**	**$5,937**	**0**	**$5,937**	**$0**	**$8,757**	**20.2**	**8.2**

** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $177 /1000kwh



Area Output*
1,007 m2
10,836 ft2

Perimeter Output*
191 m
628 ft

Available Roof Space for PV:
(Area Output - 10 ft x Perimeter) x 85%
4,556 ft2

Approximate System Size: Is the roof flat? (Yes/No) Yes

8 watt/ft2
36,446 DC watts
30 kW Enter into PV Watts

PV Watts Inputs***

Array Tilt Angle	20	Enter into PV Watts (always 20 if flat, if pitched - enter estimated roof angle)
Array Azimuth	180	Enter into PV Watts (default)
Zip Code	07834	Enter into PV Watts
DC/AC Derate Factor	0.83	Enter info PV Watts

PV Watts Output
49,475 annual kWh calculated in PV Watts program

% Offset Calc

Usage	322,452	(from utilities)
PV Generation	49,475	(generated using PV Watts)
% offset	15%	

* http://www.freemaptools.com/area-calculator.htm
** http://www.flettexchange.com
*** http://gisatnrel.nrel.gov/PVWatts_Viewer/index.html

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at http://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

Disclaimer: The PVWatts® Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department Of Energy ("DOE") and may be used for any purpose whatsoever.

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any support, consulting, training or assistance of any kind with regard to the use of the Model or any updates, revisions or new versions of the Model.

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RESULTS

49,475 kWh per Year *

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.91	3,067	368
February	3.51	3,285	394
March	4.21	4,306	517
April	4.19	4,079	490
May	5.95	5,835	700
June	6.27	5,803	696
July	5.24	5,017	602
August	4.75	4,554	547
September	5.09	4,725	567
October	3.55	3,538	425
November	2.73	2,688	323
December	2.49	2,578	309
Annual	**4.24**	**49,475**	**$ 5,938**

Location and Station Identification

Requested Location	400 east main street denville nj
Weather Data Source	(TMY3) CALDWELL/ESSEX CO., NJ 10 mi
Latitude	40.88° N
Longitude	74.28° W

PV System Specifications *(Residential)*

DC System Size	40 kW
Module Type	Premium
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.12 $/kWh
Initial Cost	4.00 $/Wdc
Cost of Electricity Generated by System	0.26 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

APPENDIX F

Photos



1: Existing HHW Boilers



2: Existing HHW Pumps



3: Packaged Chiller/Free Cooling RTU

APPENDIX G

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

Building 6

8

ENERGY STAR® Score[1]

Primary Property Function: K-12 School
Gross Floor Area (ft²): 39,845
Built: 2004

For Year Ending: May 31, 2014
Date Generated: October 30, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Building 6 400 East Main Street Denville, New Jersey 07834	Morris County Vocational School District 400 E Main Street Denville, NJ 07834 (____)____-_____	Mike Orlovsky 400 E Main Street Denville, NJ 07834 (518)453-3980 mdewein@chacompanies.com

Property ID: 4198221

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
101.1 kBtu/ft²

Source EUI
187.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	1,554,828 (39%)
Natural Gas (kBtu)	2,472,991 (61%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	64.1
National Median Source EUI (kBtu/ft²)	119
% Diff from National Median Source EUI	58%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	340

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp
(if applicable)

APPENDIX 2 ECM CALCULATIONS

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Morris County Vo-Tech
Exhibit D
ECM 1A LED Lighting
Lighting Upgrade and Heating Penalty

ECM DESCRIPTION

Retrofit existing lighting fixtures with new energy efficient lighting fixtures, install motion sensors and implement daylight harvesting in selected areas

DATA / ASSUMPTIONS

* Heating Season	20	Weeks
** Fraction of heat to be made-up	40.0%	
Heating Hours (Weather Data)	3,863	Hours

** Fraction of the Year Representing the Cooling Season Liberal estimate of the heating season, as there are times during the year when the building is neither heated nor cooled.
*** Fraction of the Lighting Reduction that Has to Be Made Up by Heating a portion of the lighting heat is released at night plus interior zones will have limited heating loads

MEASUREMENT AND VERIFICATION

Option A - The Engineering Calculations are based on 5% of the retrofitted lighting fixtures direct kW measurements and operating hours. The kW Measurements are taken for existing lighting fixtures before removal and for new installed lighting fixtures. Lighting operating hours are agreed by client basis from the audit, logging data, and operating personal input. The occupancy sensors savings are calculated as % of operating hours based on logging data and historical statistical data

COMMISSIONING

Confirm lighting operation and occupancy sensors functions

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Lighting Savings (kWh)	Lighting Savings (kW)	Lighting Hours Check (hrs)
Building 1/2/3/5/6	169,025	66.34	2,548
Building 4	81,153	36.96	2,196

Totals	**250,178**	**103**	

CALCULATIONS

	Building 1/2/3/5/6	Building 4
Lighting Derate	0%	0%
Lighting Savings	169,025	81,153
kW Savings	66	37
Heating Season	20	20
** % of Heating Season	38%	38%
***Fraction of Heat to be Made-up	40%	40%
****Annual Equivalent of Lighting kWh Saved in Therms	5,767	2,769
Current Boiler Efficiency	78.0%	93.0%
Heating Penalty (Therms)	(1,138)	(458)

Morris County Vocational Operation Costs Analysis
Lighitng Retrofit

School	Morris County Vo-Tech	Total Counts
4 ' Tube Count	4869	4869
Tube Cost	$1.00	$1.50
Annual Cost	$4,869.00	$4,869.00
4' Ballast Count	1597	1597
Ballast Cost	$5.00	$5.00
Annual Cost	$7,985.00	$7,985.00
Metal Halide - Mecury Vapor Count	11	11
Bulb Cost	$5.00	$5.00
Annual Cost	$55.00	$55.00
Ballast Count	11	11
Ballast Cost	$15.00	$15.00
Annual Cost	$165.00	$165.00
Incandescents /Exits	73	73
Cost	$1.00	$1.00
Annual Cost	$73.00	$73.00
Total Lighting Ops Savings	$13,147	$13,147

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 1	1	1	Old Reception Office	2444T8	LT44	4	4	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	3	2,514	0.44	0.16	0.27	1,098	412	686
Morris County Vo Tech NJ	Building 1	2	1	Superintendent Reception	2434T8	LT34	5	5	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	36	120	TRUE	3	2,514	0.41	0.15	0.26	1,042	386	656
Morris County Vo Tech NJ	Building 1	3	1	Superintendent Reception	2434T8BB	LT34BB	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131
Morris County Vo Tech NJ	Building 1	4	1	Superintendent Reception	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	5	1	Superintendent Office	2434T8DS	LT34DS	4	4	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.35	0.12	0.23	882	309	574
Morris County Vo Tech NJ	Building 1	6	1	Conference Room	2232T8	LT32	7	7	0.0510	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps	20	120	TRUE	16	720	0.35	0.16	0.18	251	118	133
Morris County Vo Tech NJ	Building 1	7	1	Conference Room	2232T8EMBB	LT32BB	1	1	0.0510	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps		120	TRUE	1	8,760	0.05	0.02	0.03	436	205	231
Morris County Vo Tech NJ	Building 1	8	1	Conference Room	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	9	1	Break Rm	2232T8	LT32	1	1	0.0510	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps	30	120	TRUE	16	720	0.05	0.02	0.03	36	17	19
Morris County Vo Tech NJ	Building 1	10	1	Office 6	2434T8	LT34	4	4	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.33	0.12	0.21	833	309	525
Morris County Vo Tech NJ	Building 1	11	1	Superintendent Closet	2444T8	LT44	1	1	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps	33	120	TRUE	7	700	0.11	0.04	0.07	76	29	48
Morris County Vo Tech NJ	Building 1	12	1	Business Office	2434T8	LT34	10	10	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	36	120	TRUE	3	2,514	0.83	0.31	0.52	2,083	772	1,311
Morris County Vo Tech NJ	Building 1	13	1	Business Office	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	14	1	Business Office	FE	NR	1	1	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	15	1	Board Office Closet	2444T8	LT44	1	1	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps	33	120	TRUE	7	700	0.11	0.04	0.07	76	29	48
Morris County Vo Tech NJ	Building 1	16	1	Office 10	2444T8	LT44	2	2	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	3	2,514	0.22	0.08	0.14	549	206	343
Morris County Vo Tech NJ	Building 1	17	1	Pay Roll Office	2434T8	LT34	3	3	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	36	120	TRUE	3	2,514	0.25	0.09	0.16	625	232	393
Morris County Vo Tech NJ	Building 1	18	1	Pay Roll Office	2434T8BB	LT34BB	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	36	120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131
Morris County Vo Tech NJ	Building 1	19	1	Asst Superintendent Rec	2424T8	LT24	4	4	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	36	120	TRUE	3	2,514	0.23	0.08	0.14	569	206	363
Morris County Vo Tech NJ	Building 1	20	1	Asst Superintendent Office	2424T8	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	36	120	TRUE	3	2,514	0.17	0.06	0.11	427	154	272
Morris County Vo Tech NJ	Building 1	21	1	Office 14	2434T8	LT34	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.17	0.06	0.10	417	154	262
Morris County Vo Tech NJ	Building 1	22	1	Office 15	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	33	120	TRUE	3	2,514	0.11	0.04	0.07	284	103	181
Morris County Vo Tech NJ	Building 1	23	1	Classroom 104	2424T8	LT24	21	21	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	33	120	TRUE	29	2,200	1.19	0.43	0.76	2,613	946	1,667
Morris County Vo Tech NJ	Building 1	24	1	Classroom 104a	LED24	NR	9	9	0.0240	0.0240	LED 24w	will not be Retrofit	40	120	FALSE	29	2,200	0.21	0.21	-	463	463	-
Morris County Vo Tech NJ	Building 1	25	1	Classroom 105	2434T8DS	LT34DS	14	14	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	29	2,200	1.23	0.43	0.80	2,703	946	1,757
Morris County Vo Tech NJ	Building 1	26	1	Classroom 105	2434T8DSBB	LT34DSBB	1	1	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	29	2,200	0.09	0.03	0.06	193	68	125
Morris County Vo Tech NJ	Building 1	27	1	Classroom 106	LED24	NR	12	12	0.0240	0.0240	LED 24w	will not be Retrofit	50	120	FALSE	29	2,200	0.28	0.28	-	618	618	-
Morris County Vo Tech NJ	Building 1	28	1	Classroom 107	LED24	NR	12	12	0.0240	0.0240	LED 24w	will not be Retrofit	50	120	FALSE	29	2,200	0.28	0.28	-	618	618	-
Morris County Vo Tech NJ	Building 1	29	1	Classroom 108	2434T8DS	LT34DS	15	15	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	29	2,200	1.32	0.46	0.86	2,896	1,014	1,882
Morris County Vo Tech NJ	Building 1	30	1	Classroom 108	2434T8DSBB	LT34DSBB	1	1	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	29	2,200	0.09	0.03	0.06	193	68	125
Morris County Vo Tech NJ	Building 1	31	1	Classroom 108	FE	NR	1	1	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	32	1	Server Rm 108a	2444T8DL2	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	36	120	TRUE	7	700	0.17	0.06	0.11	119	43	76
Morris County Vo Tech NJ	Building 1	33	1	Server Rm 108b	2444T8DL2	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	36	120	TRUE	7	700	0.11	0.04	0.07	79	29	51
Morris County Vo Tech NJ	Building 1	34	1	Storage 108c	1828	LED18SLNLO	1	1	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip		120	TRUE	7	700	0.12	0.06	0.06	86	41	45
Morris County Vo Tech NJ	Building 1	35	1	Store 109	2434T8	LT34	25	25	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	29	2,200	2.07	0.77	1.30	4,558	1,689	2,869
Morris County Vo Tech NJ	Building 1	36	1	Store 109	2434T8EMBB	LT34BB	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	1	8,760	0.08	0.03	0.05	726	269	457
Morris County Vo Tech NJ	Building 1	37	1	Store 109 Fridge Lights	1414T8	LT14	3	3	0.0320	0.0105	1x4, 1-Lamp T8	LED Linear Lamp Kit, (1) 4' Lamp		120	TRUE	29	2,200	0.09	0.03	0.06	206	68	138
Morris County Vo Tech NJ	Building 1	38	1	Store 109	FE	NR	2	2	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	39	1	Storage 109a	1828	LED18SLNLO	2	2	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip		120	TRUE	7	700	0.25	0.12	0.13	172	83	89
Morris County Vo Tech NJ	Building 1	40	1	Maintenance Office	LEDLB	NR	7	7	0.1670	0.1670	LED 167w	will not be Retrofit	46	120	FALSE	3	2,514	1.14	1.14	-	2,865	2,865	-
Morris County Vo Tech NJ	Building 1	41	1	Maintenance Office	FE	NR	1	1	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	42	1	Main Office	222BX	LT22BX	12	12	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps		120	TRUE	3	2,514	0.84	0.47	0.37	2,118	1,177	941
Morris County Vo Tech NJ	Building 1	43	1	Main Office	PL42X2	LKC8NLOGR	4	4	0.0720	0.0400	CF PL (2) 42w	LED Retrofit Can Kit, 8 Inch, Normal Output		120	TRUE	3	2,514	0.28	0.16	0.12	706	392	314
Morris County Vo Tech NJ	Building 1	44	1	Main Office	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 1	45	1	Office 18	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131
Morris County Vo Tech NJ	Building 1	46	1	Office 19	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131
Morris County Vo Tech NJ	Building 1	47	1	Mail Vestibule	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	33	120	TRUE	3	2,514	0.06	0.02	0.04	142	51	91
Morris County Vo Tech NJ	Building 1	48	1	Principal Office	2434T8	LT34	4	4	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.33	0.12	0.21	833	309	525
Morris County Vo Tech NJ	Building 1	49	1	Principal Office Closet	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 1	50	1	Conference Room	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	20	120	TRUE	16	720	0.50	0.18	0.31	358	133	225
Morris County Vo Tech NJ	Building 1	51	1	Admin Office 23	2434T8	LT34	3	3	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.25	0.09	0.16	625	232	393
Morris County Vo Tech NJ	Building 1	52	1	Office 24	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	15	120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 1	53	1	Office 25	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	15	120	TRUE	3	2,514	0.08	0.03	0.05	208	77	131
Morris County Vo Tech NJ	Building 1	54	1	Office 26	2434T8	LT34	4	4	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	33	120	TRUE	3	2,514	0.33	0.12	0.21	833	309	525
Morris County Vo Tech NJ	Building 1	55	1	Office 27	2434T8	LT34	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	20	120	TRUE	3	2,514	0.17	0.06	0.10	417	154	262
Morris County Vo Tech NJ	Building 1	56	1	Mens Rm	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	20	120	TRUE	5	880	0.08	0.03	0.05	73	27	46
Morris County Vo Tech NJ	Building 1	57	1	Womens Rm	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	20	120	TRUE	5	880	0.08	0.03	0.05	73	27	46
Morris County Vo Tech NJ	Building 1	58	1	Fitness Ctr	225BX	LEDTG22HLO	14	14	0.1820	0.0440	2x2,2-Lamp Biax,	LED Troffer, HLO, 2x2		120	TRUE	3	2,514	2.48	0.60	1.88	6,246	1,510	4,736
Morris County Vo Tech NJ	Building 1	59	1	Fitness Ctr	225BXBB	LEDTG22HLOBB	3	3	0.1820	0.0440	2x2,2-Lamp Biax,	LED Troffer, HLO, 2x2		120	TRUE	3	2,514	0.53	0.13	0.40	1,338	324	1,015
Morris County Vo Tech NJ	Building 1	60	1	Fitness Ctr	225BXEMBB	LEDTG22HLOBB	1	1	0.1820	0.0440	2x2,2-Lamp Biax,	LED Troffer, HLO, 2x2		120	TRUE	1	8,760	0.18	0.04	0.13	1,554	376	1,179
Morris County Vo Tech NJ	Building 1	61	1	Fitness Ctr	K-LED	NR	4	4	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	137	137	-
Morris County Vo Tech NJ	Building 1	62	1	Mens Locker Rm	2424T8	LT24	5	5	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	22	3,553	0.28	0.10	0.18	1,005	364	641
Morris County Vo Tech NJ	Building 1	63	1	Mens Locker Rm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	22	3,553	0.06	0.02	0.04	201	73	128
Morris County Vo Tech NJ	Building 1	64	1	Mens Locker Rm	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	22	3,553	0.06	0.02	0.04	201	73	128
Morris County Vo Tech NJ	Building 1	65	1	Mens Locker Rm	PL42X2	LKC8NLOGR	4	4	0.0720	0.0400	CF PL (2) 42w	LED Retrofit Can Kit, 8 Inch, Normal Output		120	TRUE	3	2,514	0.28	0.16	0.12	706	392	314
Morris County Vo Tech NJ	Building 1	66	1	Lockers/ Elec Rm	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 1	67	1	Mens Office	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	3	2,514	0.11	0.04	0.07	284	103	181
Morris County Vo Tech NJ	Building 1	68	1	Mens Locker Rm	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 1	69	1	Womens Locker Rm	2424T8	LT24	5	5	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	22	3,553	0.28	0.10	0.18	1,005	364	641
Morris County Vo Tech NJ	Building 1	70	1	Womens Locker Rm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	22	3,553	0.06	0.02	0.04	201	73	128
Morris County Vo Tech NJ	Building 1	71	1	Womens Locker Rm	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	22	3,553	0.06	0.02	0.04	201	73	128
Morris County Vo Tech NJ	Building 1	72	1	Womens Locker Rm	PL42X2	LKC8NLOGR	4	4	0.0720	0.0400	CF PL (2) 42w	LED Retrofit Can Kit, 8 Inch, Normal Output		120	TRUE	3	2,514	0.28	0.16	0.12	706	392	314
Morris County Vo Tech NJ	Building 1	73	1	Womens Locker Rm	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 1	74	1	Lockers/ Elec Rm	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 1	75	1	Womens Office	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	3	2,514	0.11	0.04	0.07	284	103	181
Morris County Vo Tech NJ	Building 1	76	1	Mens Bathrm	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.11	0.04	0.07	249	90	159
Morris County Vo Tech NJ	Building 1	77	1	Mens Bathrm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	6	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	78	1	Womens Bathrm	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.11	0.04	0.07	249	90	159
Morris County Vo Tech NJ	Building 1	79	1	Womens Bathrm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	6	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	80	1	Athletic Storage	1424T8	LT24	4	4	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.23	0.08	0.14	158	57	101
Morris County Vo Tech NJ	Building 1	81	1	Staff Dining 113	1864T8	LT64	4	4	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	20	120	TRUE	21	3,482	0.66	0.25	0.42	2,309	856	1,453
Morris County Vo Tech NJ	Building 1	82	1	Staff Dining 113	1434T8	LT34	6	6	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	20	120	TRUE	21	3,482	0.50	0.18	0.31	1,731	642	1,090
Morris County Vo Tech NJ	Building 1	83	1	Staff Dining 113	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	84	1	Staff Dining 113	PL18X2	LKC6NLO	3	3	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	21	3,482	0.12	0.04	0.08	407	132	275
Morris County Vo Tech NJ	Building 1	85	1	Dining Hall	11294T8	LT94	16	16	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	20	120	TRUE	21	3,482	3.98	1.47	2.50	13,851	5,133	8,718
Morris County Vo Tech NJ	Building 1	86	1	Dining Hall	1434T8	LT34	8	8	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	20	120	TRUE	21	3,482	0.66	0.25	0.42	2,309	856	1,453
Morris County Vo Tech NJ	Building 1	87	1	Dining Hall	1864T8	LT64	12	12	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	20	120	TRUE	21	3,482	1.99	0.74	1.25	6,926	2,567	4,359
Morris County Vo Tech NJ	Building 1	88	1	Dining Hall	2424T8	LT24	5	5	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	21	3,482	0.28	0.10	0.18	985	356	628
Morris County Vo Tech NJ	Building 1	89	1	Dining Hall	PL18X2	LKC6NLO	17	17	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	21	3,482	0.66	0.22	0.45	2,309	750	1,558
Morris County Vo Tech NJ	Building 1	90	1	Dining Hall	K-LED	NR	4	4	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	137	137	-
Morris County Vo Tech NJ	Building 1	91	1	Freezer Storage	1424T8	LT24	4	4	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.23	0.08	0.14	158	57	101
Morris County Vo Tech NJ	Building 1	92	1	Storage	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	7	700	0.08	0.03	0.05	58	21	37
Morris County Vo Tech NJ	Building 1	93	1	Storage Hall	2444T8	LT44	2	2	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	9	4,786	0.22	0.08	0.14	1,045	392	653
Morris County Vo Tech NJ	Building 1	94	1	Storage Hall	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	95	1	Kitchen	2444T8	LT44	21	21	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	21	3,482	2.29	0.86	1.43	7,985	2,994	4,991
Morris County Vo Tech NJ	Building 1	96	1	Kitchen Hoods	1424T8	LT24	2	2	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	21	3,482	0.11	0.04	0.07	394	143	251
Morris County Vo Tech NJ	Building 1	97	1	Kitchen Hoods	CFL23	LANLO	6	6	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	21	3,482	0.13	0.05	0.08	469	183	285
Morris County Vo Tech NJ	Building 1	98	1	Kitchen Storage	2444T8	LT44	1	1	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	7	700	0.11	0.04	0.07	76	29	48
Morris County Vo Tech NJ	Building 1	99	1	Classroom 129	2424T8	LT24	13	13	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	36	120	TRUE	29	2,200	0.74	0.27	0.47	1,617	586	1,032
Morris County Vo Tech NJ	Building 1	100	1	Classroom 129	2434	LT34	4	4	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps	36	120	TRUE	29	2,200	0.44	0.12	0.32	978	270	708
Morris County Vo Tech NJ	Building 1	101	1	Office 46	LED14	NR	3	3	0.0140	0.0140	LED 14w	will not be Retrofit		120	FALSE	3	2,514	0.04	0.04	-	103	103	-
Morris County Vo Tech NJ	Building 1	102	1	Copy Rm	2444T8	LT44	4	4	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	3	2,514	0.44	0.16	0.27	1,098	412	686
Morris County Vo Tech NJ	Building 1	103	1	Attendance Office	2444T8	LT44	4	4	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	3	2,514	0.44	0.16	0.27	1,098	412	686
Morris County Vo Tech NJ	Building 1	104	1	Asst Principal	2444T8	LT44	2	2	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	3	2,514	0.22	0.08	0.14	549	206	343
Morris County Vo Tech NJ	Building 1	105	1	Cosmotology Vest	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	106	1	Cosmotology 103	1864T8	LT64	10	10	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	29	2,200	1.66	0.61	1.04	3,647	1,351	2,295
Morris County Vo Tech NJ	Building 1	107	1	Cosmotology 103	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	108	1	Locker Rm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 1	109	1	Storage	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 1	110	1	Storage	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 1	111	1	Cadd Classroom 102a	1864T8	LT64	6	6	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	53	120	TRUE	29	2,200	0.99	0.37	0.63	2,188	811	1,377
Morris County Vo Tech NJ	Building 1	112	1	Cadd Classrm Closet	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.06	0.01	0.05	41	6	35
Morris County Vo Tech NJ	Building 1	113	1	Fac Womens Rm	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	5	880	0.06	0.02	0.04	50	18	32
Morris County Vo Tech NJ	Building 1	114	1	Fac Mens Rm	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	5	880	0.06	0.02	0.04	50	18	32
Morris County Vo Tech NJ	Building 1	115	1	Womens Rm	2222T8	LT22	1	1	0.0340	0.0160	2x2, 2-Lamp T8	LED Int. Driver Lamps, (2) 2' Lamps	20	120	TRUE	6	2,200	0.03	0.02	0.02	73	34	39
Morris County Vo Tech NJ	Building 1	116	1	Womens Rm	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	6	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 1	117	1	Womens Rm	I60X2	LANLOX2	2	2	0.1200	0.0180	Inc (2) 60w	LED Lamp, A-Line, NLO, x2		120	TRUE	6	2,200	0.23	0.04	0.20	515	77	438
Morris County Vo Tech NJ	Building 1	118	1	Womens Rm	FE	NR	2	2	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	119	1	Janitorial	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.06	0.01	0.05	41	6	35
Morris County Vo Tech NJ	Building 1	120	1	Mens Rm	CIRC22	LEDDRM01LM	5	5	0.0260	0.0090	Circline 22w	LED 9w Drum		120	TRUE	6	2,200	0.13	0.04	0.08	279	97	182
Morris County Vo Tech NJ	Building 1	121	1	Mens Rm	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	20	120	TRUE	6	2,200	0.28	0.08	0.20	618	180	438
Morris County Vo Tech NJ	Building 1	122	1	Mens Rm	FE	NR	1	1	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	123	1	Cosmotology 102	1864T8	LT64	4	4	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	29	2,200	0.66	0.25	0.42	1,459	541	918
Morris County Vo Tech NJ	Building 1	124	1	Cosmotology 102	11294T8	LT94	4	4	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	55	120	TRUE	29	2,200	0.99	0.37	0.63	2,188	811	1,377
Morris County Vo Tech NJ	Building 1	125	1	Storage 102	2434	LT34L24	1	1	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	7	700	0.11	0.03	0.08	78	21	56
Morris County Vo Tech NJ	Building 1	126	1	Locker Rm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	127	1	Locker Rm	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	128	1	Cosmotology 101	1864T8	LT64	4	4	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	29	2,200	0.66	0.25	0.42	1,459	541	918
Morris County Vo Tech NJ	Building 1	129	1	Cosmotology 101	11294T8	LT94	4	4	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	55	120	TRUE	29	2,200	0.99	0.37	0.63	2,188	811	1,377
Morris County Vo Tech NJ	Building 1	130	1	Locker Rm	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	131	1	Locker Rm	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.06	0.02	0.04	124	45	79
Morris County Vo Tech NJ	Building 1	132	1	Main Entry Vest	LEDPAR	NR	2	2	0.0180	0.0180	LED 18w	will not be Retrofit		120	FALSE	9	4,786	0.04	0.04	-	168	168	-
Morris County Vo Tech NJ	Building 1	133	1	Main Entry	LEDPAR	NR	2	2	0.0180	0.0180	LED 18w	will not be Retrofit		120	FALSE	9	4,786	0.04	0.04	-	168	168	-
Morris County Vo Tech NJ	Building 1	134	1	Main Entry	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.84	0.25	0.60	4,032	1,176	2,856
Morris County Vo Tech NJ	Building 1	135	1	Hallway H2	LED14	NR	14	14	0.0140	0.0140	LED 14w	will not be Retrofit		120	FALSE	9	4,786	0.19	0.19	-	915	915	-
Morris County Vo Tech NJ	Building 1	136	1	Hallway H2	LED14EM	NR	4	4	-		No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	137	1	Hallway H2	FE	NR	4	4	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	138	1	Hallway H2	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-
Morris County Vo Tech NJ	Building 1	139	1	Hallway H3	LED14	NR	15	15	0.0140	0.0140	LED 14w	will not be Retrofit		120	FALSE	9	4,786	0.20	0.20	-	980	980	-
Morris County Vo Tech NJ	Building 1	140	1	Hallway H3	LED14EM	NR	7	7	-		No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	141	1	Hallway H3	FE	NR	4	4	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	142	1	Hallway H3	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 1	143	1	Hallway H3	1313T8	LT13	1	1	0.0260	0.0120	1x3, 1-Lamp T8	LED Int. Driver Lamp, (1) 3' Lamp		120	TRUE	9	4,786	0.03	0.01	0.01	121	56	65
Morris County Vo Tech NJ	Building 1	144	1	Hallway H3	2444T8	LT44	1	1	0.1120	0.0420	2x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	9	4,786	0.11	0.04	0.07	523	196	327
Morris County Vo Tech NJ	Building 1	145	1	Hallway H4	2424T8BB	LT24BB	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	9	4,786	0.17	0.06	0.11	812	294	518
Morris County Vo Tech NJ	Building 1	146	1	Hallway H4	2424T8	LT24	4	4	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.23	0.08	0.14	1,083	392	691
Morris County Vo Tech NJ	Building 1	147	1	Hallway H4	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 1	148	1	Hallway H5	2424T8EMBB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	1	8,760	0.06	0.02	0.04	495	179	316
Morris County Vo Tech NJ	Building 1	149	1	Hallway H5	2424T8	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.17	0.06	0.11	812	294	518
Morris County Vo Tech NJ	Building 1	150	1	Hallway H5	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 1	151	1	Hallway H5	LED14	NR	3	3	0.0140	0.0140	LED 14w	will not be Retrofit		120	FALSE	9	4,786	0.04	0.04	-	196	196	-
Morris County Vo Tech NJ	Building 1	152	1	Hallway H5	LED14EM	NR	2	2	-		No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	153	1	Hallway H5	FE	NR	1	1	-		Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 1	154	1	Hallway H5 Outside 103	2424T8EMBB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB		120	TRUE	1	8,760	0.06	0.02	0.04	495	179	316
Morris County Vo Tech NJ	Building 1	155	Ext	Exterior Parking Lot	S150	NR	7	7	0.1880	0.1880	HPS 150w	will not be Retrofit		120	FALSE	10	4,380	1.28	1.28	-	5,620	5,620	-
Morris County Vo Tech NJ	Building 2	1	1	Boiler Rm	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 2	2	1	Restroom R1	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	5	880	0.06	0.02	0.04	50	18	32
Morris County Vo Tech NJ	Building 2	3	1	Cst Office 207a	2434T8	LT34	6	6	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.50	0.18	0.31	1,250	463	787
Morris County Vo Tech NJ	Building 2	4	1	Cst Office 207b	2434T8DS	LT34DS	2	2	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.18	0.06	0.11	441	154	287
Morris County Vo Tech NJ	Building 2	5	1	Office 207	2434T8	LT34	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.17	0.06	0.10	417	154	262
Morris County Vo Tech NJ	Building 2	6	1	Break Rm B2	2434T8DSBB	LT34DSBB	1	1	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.09	0.03	0.06	221	77	143

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 2	7	1	Break Rm B2	2434T8DS	LT34DS	3	3	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.26	0.09	0.17	662	232	430
Morris County Vo Tech NJ	Building 2	8	1	Esl Classroom 206	2232T8DS	LT32DS	7	7	0.0540	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps		120	TRUE	29	2,200	0.37	0.16	0.20	811	360	450
Morris County Vo Tech NJ	Building 2	9	1	Esl Classroom 206	2232T8DSBB	LT32DSBB	1	1	0.0540	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps		120	TRUE	29	2,200	0.05	0.02	0.03	116	51	64
Morris County Vo Tech NJ	Building 2	10	1	Closet 206a	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 2	11	1	Office Area 205	2434T8DS	LT34DS	9	9	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.79	0.28	0.51	1,985	695	1,291
Morris County Vo Tech NJ	Building 2	12	1	Office Area 205	2434T8DSBB	LT34DSBB	1	1	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.09	0.03	0.06	221	77	143
Morris County Vo Tech NJ	Building 2	13	1	Office Area 205	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 2	14	1	Office 205a	2434T8DS	LT34DS	4	4	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	32	120	TRUE	3	2,514	0.35	0.12	0.23	882	309	574
Morris County Vo Tech NJ	Building 2	15	1	Men's Bathrm	1414T8	LT14	1	1	0.0320	0.0105	1x4, 1-Lamp T8	LED Linear Lamp Kit, (1) 4' Lamp		120	TRUE	6	2,200	0.03	0.01	0.02	69	23	46
Morris County Vo Tech NJ	Building 2	16	1	Men's Bathrm	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	6	2,200	0.08	0.03	0.05	182	68	115
Morris County Vo Tech NJ	Building 2	17	1	Men's Bathrm	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 2	18	1	Women's Bathrm	1414T8	LT14	2	2	0.0320	0.0105	1x4, 1-Lamp T8	LED Linear Lamp Kit, (1) 4' Lamp		120	TRUE	6	2,200	0.06	0.02	0.04	137	45	92
Morris County Vo Tech NJ	Building 2	19	1	Women's Bathrm	1444	LT44	1	1	0.1440	0.0420	1x4, 4-Lamp T12	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	6	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 2	20	1	Classrm 202	2434T8DS	LT34DS	9	9	0.0900	0.0315	2x4, 3-Lamp T8, DS	LED Int. Driver Lamps, (3) 4' Lamps	60	120	TRUE	29	2,200	0.79	0.28	0.51	1,737	608	1,129
Morris County Vo Tech NJ	Building 2	21	1	Classrm 202	2232T8DS	LT32DS	3	3	0.0540	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps	60	120	TRUE	29	2,200	0.16	0.07	0.09	347	154	193
Morris County Vo Tech NJ	Building 2	22	1	Classrm 202	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 2	23	1	Classrm 203	2434T8	LT34	9	9	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	60	120	TRUE	29	2,200	0.75	0.28	0.47	1,641	608	1,033
Morris County Vo Tech NJ	Building 2	24	1	Classrm 203	2232T8	LT32	3	3	0.0510	0.0240	2x2, 3-Lamp T8	LED Int. Driver Lamps, (3) 2' Lamps	60	120	TRUE	29	2,200	0.15	0.07	0.08	328	154	174
Morris County Vo Tech NJ	Building 2	25	1	Classrm 203	1424T8	LT24	3	3	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.17	0.06	0.11	373	135	238
Morris County Vo Tech NJ	Building 2	26	1	Classrm 203	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 2	27	1	Classrm 204	2434T8	LT34	11	11	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	0.91	0.34	0.57	2,006	743	1,262
Morris County Vo Tech NJ	Building 2	28	1	Classrm 204	222UT8	LT32R22	3	3	0.0580	0.0240	2x2, 2-Lamp U T8	LED Linear Lamp Kit, (3) 2' Lamps	60	120	TRUE	29	2,200	0.17	0.07	0.10	373	154	219
Morris County Vo Tech NJ	Building 2	29	1	Classrm 204	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 2	30	1	Closet 204a	222U	LT32R22L	1	1	0.0720	0.0240	2x2, 2-Lamp U T12	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	16	33
Morris County Vo Tech NJ	Building 2	31	1	Athletic Trainer 204b	2434T8	LT34	3	3	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	3	2,514	0.25	0.09	0.16	625	232	393
Morris County Vo Tech NJ	Building 2	32	1	Athletic Trainer 204b	222UT8	LT32R22	1	1	0.0580	0.0240	2x2, 2-Lamp U T8	LED Linear Lamp Kit, (3) 2' Lamps	45	120	TRUE	3	2,514	0.06	0.02	0.03	142	59	83
Morris County Vo Tech NJ	Building 2	33	1	Bathrm 204c	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	5	880	0.06	0.02	0.04	50	18	32
Morris County Vo Tech NJ	Building 2	34	1	Classrm 205	2434T8	LT34	18	18	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	1.49	0.55	0.94	3,282	1,216	2,066
Morris County Vo Tech NJ	Building 2	35	1	Classrm 205	222UT8	LT32R22	2	2	0.0580	0.0240	2x2, 2-Lamp U T8	LED Linear Lamp Kit, (3) 2' Lamps	60	120	TRUE	29	2,200	0.11	0.05	0.07	249	103	146
Morris County Vo Tech NJ	Building 2	36	1	Classrm 205	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 2	37	1	Storage 205b	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 2	38	1	Storage 208	1424T8	LT24	2	2	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.11	0.04	0.07	79	29	51
Morris County Vo Tech NJ	Building 2	39	1	Storage 208	1844T8	LT44	5	5	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	7	700	0.55	0.20	0.34	382	143	239
Morris County Vo Tech NJ	Building 2	40	1	Janitorial 209	1414T8	LT14	1	1	0.0320	0.0105	1x4, 1-Lamp T8	LED Linear Lamp Kit, (1) 4' Lamp		120	TRUE	7	700	0.03	0.01	0.02	22	7	15
Morris County Vo Tech NJ	Building 2	41	1	Hallway	1323T8EMBB	LT23BB	4	4	0.0460	0.0240	1x3, 2-Lamp T8	LED Int. Driver Lamps, (2) 3' Lamps		120	TRUE	1	8,760	0.18	0.09	0.09	1,572	820	752
Morris County Vo Tech NJ	Building 2	42	1	Hallway	1323T8	LT23	22	22	0.0460	0.0240	1x3, 2-Lamp T8	LED Int. Driver Lamps, (2) 3' Lamps		120	TRUE	1	8,760	0.99	0.51	0.47	8,643	4,510	4,134
Morris County Vo Tech NJ	Building 2	43	1	Hallway	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-
Morris County Vo Tech NJ	Building 2	44	1	Hallway	FE	NR	5	5	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	1	1	Grounds Supervisor Office	2222BX	LT22BX	4	4	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	22	120	TRUE	3	2,514	0.28	0.16	0.12	706	392	314
Morris County Vo Tech NJ	Building 3	2	1	Veterinary Classroom 302a	LEDHB	NR	16	16	0.1670	0.1670	LED 167w	will not be Retrofit	32	120	FALSE	29	2,200	2.61	2.61	-	5,731	5,731	-
Morris County Vo Tech NJ	Building 3	3	1	Veterinary Classroom 302a	222U	LT32R22	1	1	0.0720	0.0240	2x2, 2-Lamp U T12	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	112	224
Morris County Vo Tech NJ	Building 3	4	1	Veterinary Classroom 302a	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 3	5	1	Animal Pen 302b	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.11	0.04	0.07	249	90	159
Morris County Vo Tech NJ	Building 3	6	1	Bathroom 302c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	7	1	Storage 302d	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	15	120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 3	8	1	Storage 302e	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	15	120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 3	9	1	Upper Storage	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 3	10	1	Upper Storage	I60	LANLO	6	6	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.35	0.05	0.30	246	37	209
Morris County Vo Tech NJ	Building 3	11	1	Design Classroom 302	LED24	NR	20	20	0.0240	0.0240	LED 24w	will not be Retrofit	32	120	FALSE	29	2,200	0.47	0.47	-	1,030	1,030	-
Morris County Vo Tech NJ	Building 3	12	1	Design Classroom 302	LEDCAN	NR	1	1	0.0140	0.0140	LED 14w	will not be Retrofit	32	120	FALSE	29	2,200	0.01	0.01	-	30	30	-
Morris County Vo Tech NJ	Building 3	13	1	Design Classroom 302	LED14	NR	2	2	0.0140	0.0140	LED 14w	will not be Retrofit	90	120	FALSE	9	4,786	0.03	0.03	-	131	131	-
Morris County Vo Tech NJ	Building 3	14	1	Design Classroom 302	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	15	1	3d Printer 302f	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	60	120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 3	16	1	3d Printer 302f	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	60	120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 3	17	1	Bathroom 302g	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	18	1	Storage 302h	LED14	NR	2	2	0.0140	0.0140	LED 14w	will not be Retrofit	90	120	FALSE	7	700	0.03	0.03	-	19	19	-
Morris County Vo Tech NJ	Building 3	19	1	Storage 302i	LED14	NR	2	2	0.0140	0.0140	LED 14w	will not be Retrofit	90	120	FALSE	7	700	0.03	0.03	-	19	19	-
Morris County Vo Tech NJ	Building 3	20	1	Storage 302j	LED14	NR	2	2	0.0140	0.0140	LED 14w	will not be Retrofit	90	120	FALSE	7	700	0.03	0.03	-	19	19	-
Morris County Vo Tech NJ	Building 3	21	1	Boiler Rm	1424	LT24	16	16	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	1.12	0.33	0.80	786	229	557
Morris County Vo Tech NJ	Building 3	22	1	Boiler Rm	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	23	1	Boiler Rm	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 3	24	1	Janitorial	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 3	25	1	Construction Classroom 303	LEDHB	NR	20	20	0.1670	0.1670	LED 167w	will not be Retrofit	45	120	FALSE	29	2,200	3.26	3.26	-	7,164	7,164	-
Morris County Vo Tech NJ	Building 3	26	1	Construction Classroom 303	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 3	27	1	Construction Classroom 303	222U	LT32R22	1	1	0.0720	0.0240	2x2, 2-Lamp U T12	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	112	224
Morris County Vo Tech NJ	Building 3	28	1	Construction Classroom 303	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	29	1	Upper Storage	CFL23	LANLO	6	6	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.13	0.05	0.08	94	37	57
Morris County Vo Tech NJ	Building 3	30	1	Bathroom 303a	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 3	31	1	Office 303b	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.28	0.08	0.20	618	180	438
Morris County Vo Tech NJ	Building 3	32	1	Lockers 303c	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 3	33	1	Storage 303d	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 3	34	1	Storage 303e	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 3	35	1	Storage 303e	1424	LT24L14	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 3	36	1	Carpentry Classroom 304	LEDHB	NR	20	20	0.1670	0.1670	LED 167w	will not be Retrofit	45	120	FALSE	29	2,200	3.26	3.26	-	7,164	7,164	-
Morris County Vo Tech NJ	Building 3	37	1	Carpentry Classroom 304	222U	LT32R22	1	1	0.0720	0.0240	2x2, 2-Lamp U T12	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	112	224
Morris County Vo Tech NJ	Building 3	38	1	Carpentry Classroom 304	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 3	39	1	Carpentry Classroom 304	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	40	1	Upper Storage	CFL23	LANLO	6	6	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.13	0.05	0.08	94	37	57
Morris County Vo Tech NJ	Building 3	41	1	Bathroom 304a	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	42	1	Office 304b	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.28	0.08	0.20	618	180	438
Morris County Vo Tech NJ	Building 3	43	1	Lockers 304c	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 3	44	1	Storage 304d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 3	45	1	Storage 304d	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 3	46	1	Electrical Classroom 305	LEDHB	NR	14	14	0.1670	0.1670	LED 167w	will not be Retrofit	45	120	FALSE	29	2,200	2.28	2.28	-	5,015	5,015	-
Morris County Vo Tech NJ	Building 3	47	1	Electrical Classroom 305	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	98	238
Morris County Vo Tech NJ	Building 3	48	1	Electrical Classroom 305	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 3	49	1	Electrical Classroom 305	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	50	1	Upper Storage	I65	LR30NLO	2	2	0.0650	0.0110	Inc 65w	LED Lamp, R/PAR30, NLO		120	TRUE	7	700	0.13	0.02	0.11	89	15	74
Morris County Vo Tech NJ	Building 3	51	1	Upper Storage	222UT8	LT32R22L	1	1	0.0580	0.0240	2x2, 2-Lamp U T8	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	7	700	0.06	0.02	0.03	40	16	23
Morris County Vo Tech NJ	Building 3	52	1	Upper Storage	222UT8	LT32R22	2	2	0.0580	0.0240	2x2, 2-Lamp U T8	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	7	700	0.11	0.05	0.07	79	33	46
Morris County Vo Tech NJ	Building 3	53	1	Upper Storage	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.06	0.01	0.05	41	6	35
Morris County Vo Tech NJ	Building 3	54	1	Lockers 305b	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 3	55	1	Storage 305c	1444	LT24	3	3	0.1440	0.0210	1x4, 4-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.42	0.06	0.36	295	43	252
Morris County Vo Tech NJ	Building 3	56	1	Tool Storage 305d	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 3	57	1	Sprinkler Rm 305e	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 3	58	1	Bathroom 305a	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	59	1	Plumber Classroom 306	LEDHB	NR	10	10	0.1670	0.1670	LED 167w	will not be Retrofit	45	120	FALSE	29	2,200	1.63	1.63	-	3,582	3,582	-
Morris County Vo Tech NJ	Building 3	60	1	Plumber Classroom 306	222U	LT32R22	1	1	0.0720	0.0240	2x2, 2-Lamp U T12	LED Linear Lamp Kit, (3) 2' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	112	224
Morris County Vo Tech NJ	Building 3	61	1	Plumber Classroom 306	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 3	62	1	Plumber Classroom 306	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	63	1	Upper Storage	CFL23	LANLO	1	1	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	7	700	0.02	0.01	0.01	16	6	10
Morris County Vo Tech NJ	Building 3	64	1	Upper Storage	LED24	NR	1	1	0.0240	0.0240	LED 24w	will not be Retrofit	32	120	FALSE	7	700	0.02	0.02	-	16	16	-
Morris County Vo Tech NJ	Building 3	65	1	Bathroom 306a	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	66	1	Office 306b	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.28	0.08	0.20	618	180	438
Morris County Vo Tech NJ	Building 3	67	1	Lockers 306c	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 3	68	1	Lockers 306c	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 3	69	1	Storage 306d	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	7	700	0.14	0.04	0.10	98	29	70

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 3	70	1	Upper Storage	LED24	NR	1	1	0.0240	0.0240	LED 24w	will not be Retrofit	32	120	FALSE	7	700	0.02	0.02	-	16	16	-
Morris County Vo Tech NJ	Building 3	71	1	Bathroom, Women's	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.11	0.04	0.07	249	90	159
Morris County Vo Tech NJ	Building 3	72	1	Janitorial	PL18X2	LEDDRM01LM	1	1	0.0400	0.0090	CF PL (2) 18w	LED 9w Drum		120	TRUE	7	700	0.04	0.01	0.03	27	6	21
Morris County Vo Tech NJ	Building 3	73	1	Bathroom, Men's	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	32	120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 3	74	1	Bathroom, Men's	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	75	1	Music Classroom 301a	2434	LT34	8	8	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	0.89	0.25	0.64	1,956	541	1,416
Morris County Vo Tech NJ	Building 3	76	1	Music Classroom 301	2434	LT34	8	8	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	0.89	0.25	0.64	1,956	541	1,416
Morris County Vo Tech NJ	Building 3	77	1	Hallway H1	LED24	NR	5	5	0.0240	0.0240	LED 24w	will not be Retrofit		120	FALSE	9	4,786	0.12	0.12	-	560	560	-
Morris County Vo Tech NJ	Building 3	78	1	Hallway H1	LED24EM	NR	4	4	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	79	1	Hallway H1	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-
Morris County Vo Tech NJ	Building 3	80	1	Hallway H1	FE	NR	2	2	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	81	1	Hallway H2	LED24	NR	6	6	0.0240	0.0240	LED 24w	will not be Retrofit		120	FALSE	9	4,786	0.14	0.14	-	672	672	-
Morris County Vo Tech NJ	Building 3	82	1	Hallway H2	LED24EM	NR	5	5	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 3	83	1	Hallway H2	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 3	84	1	Hallway H2	FE	NR	2	2	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	1	1	Classroom 401a	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	30	120	TRUE	29	2,200	0.84	0.25	0.60	1,853	541	1,313
Morris County Vo Tech NJ	Building 4	2	1	Auto Body 401	LEDHB	NR	16	16	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.61	2.61	-	5,731	5,731	-
Morris County Vo Tech NJ	Building 4	3	1	Auto Body 401	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	4	1	Upper Storage 401	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.28	0.08	0.20	197	57	139
Morris County Vo Tech NJ	Building 4	5	1	Upper Storage 401	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	6	1	Tool Storage 401b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	7	1	Liquid Storage 401c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	8	1	Locker Rm 401d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	9	1	Bathrm 401e	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	10	1	Office 401f	1424	LT24	5	5	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.35	0.10	0.25	772	225	547
Morris County Vo Tech NJ	Building 4	11	1	Bathrm 401f	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	12	1	Classroom 402a	1424	LT24	11	11	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	30	120	TRUE	29	2,200	0.77	0.23	0.55	1,699	495	1,203
Morris County Vo Tech NJ	Building 4	13	1	Classroom 402a	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	14	1	Auto Body 402	LEDHB	NR	15	15	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.44	2.44	-	5,373	5,373	-
Morris County Vo Tech NJ	Building 4	15	1	Auto Body 402	1414T8	LT14	1	1	0.0320	0.0105	1x4, 1-Lamp T8	LED Linear Lamp Kit, (1) 4' Lamp		120	TRUE	29	2,200	0.03	0.01	0.02	69	23	46
Morris County Vo Tech NJ	Building 4	16	1	Auto Body 402	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	17	1	Upper Storage 402	1424	LT24	5	5	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.35	0.10	0.25	246	72	174
Morris County Vo Tech NJ	Building 4	18	1	Tool Storage 402b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	19	1	Liquid Storage 402c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	20	1	Locker Rm 402d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	21	1	Bathrm 402e	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	22	1	Office 402f	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 4	23	1	Bathrm 402f	I60	LEDDRM01LM	1	1	0.0600	0.0090	Inc 60w	LED 9w Drum		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	24	1	Classroom 403a	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.84	0.25	0.60	1,853	541	1,313
Morris County Vo Tech NJ	Building 4	25	1	Auto Body 403	LEDHB	NR	13	13	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.12	2.12	-	4,657	4,657	-
Morris County Vo Tech NJ	Building 4	26	1	Auto Body 403	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	27	1	Paint Booth 403b	2343T8	LTBR43H	27	27	0.0910	0.0572	2x3, 4-Lamp T8	LED Ballast Ready Lamp, (4) 3' Lamps, T8 Ballast		120	TRUE	29	2,200	2.40	1.51	0.89	5,270	3,313	1,958
Morris County Vo Tech NJ	Building 4	28	1	Paint Storage 403c	H175	NR	2	2	0.2050	0.2050	MV 175w	will not be Retrofit		120	FALSE	7	700	0.40	0.40	-	280	280	-
Morris County Vo Tech NJ	Building 4	29	1	Locker Rm 403d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	30	1	Bathrm 403e	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	31	1	Office 403f	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 4	32	1	Bathrm 403f	I60	LEDDRM01LM	1	1	0.0600	0.0090	Inc 60w	LED 9w Drum		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	33	1	Storage 403g	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	34	1	Storage 403h	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	35	1	Upper Storage 403	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 4	36	1	Auto Body 404	LEDHB	NR	14	14	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.28	2.28	-	5,015	5,015	-
Morris County Vo Tech NJ	Building 4	37	1	Auto Body 404	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	38	1	Paint Booth 404b	2343T8	LTBR43H	27	27	0.0910	0.0572	2x3, 4-Lamp T8	LED Ballast Ready Lamp, (4) 3' Lamps, T8 Ballast		120	TRUE	29	2,200	2.40	1.51	0.89	5,270	3,313	1,958
Morris County Vo Tech NJ	Building 4	39	1	Storage 404c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 4	40	1	Locker Rm 404d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	41	1	Bathrm 404e	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	42	1	Office 404f	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.21	0.06	0.15	463	135	328
Morris County Vo Tech NJ	Building 4	43	1	Bathrm 404f	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	44	1	Upper Storage 404	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 4	45	1	Paint Storage 404g	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	46	1	Classroom 404a	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.84	0.25	0.60	1,853	541	1,313
Morris County Vo Tech NJ	Building 4	47	1	Classroom 405a	1424	LT24	7	7	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	30	120	TRUE	29	2,200	0.49	0.14	0.35	1,081	315	766
Morris County Vo Tech NJ	Building 4	48	1	Classroom 405a	1424	LT24L14	5	5	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.35	0.10	0.25	772	225	547
Morris County Vo Tech NJ	Building 4	49	1	Bldg Grounds 405	LEDHB	NR	15	15	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.44	2.44	-	5,373	5,373	-
Morris County Vo Tech NJ	Building 4	50	1	Bldg Grounds 405	K-LED-FE	NR	4	4	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	137	137	-
Morris County Vo Tech NJ	Building 4	51	1	Upper Storage 405	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	52	1	Upper Storage 405	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	53	1	Storage 405b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	54	1	Storage 405c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	55	1	Locker Rm 405d	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	56	1	Bathrm 405e	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	57	1	Office 405f	1424	LT24L14	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	3	2,514	0.21	0.06	0.15	529	154	375
Morris County Vo Tech NJ	Building 4	58	1	Bathrm 405f	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	59	1	Classroom 408a	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	30	120	TRUE	29	2,200	0.84	0.25	0.60	1,853	541	1,313
Morris County Vo Tech NJ	Building 4	60	1	Welding 408	LEDHB	NR	15	15	0.1670	0.1670	LED 167w	will not be Retrofit		120	FALSE	29	2,200	2.44	2.44	-	5,373	5,373	-
Morris County Vo Tech NJ	Building 4	61	1	Welding 408	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	62	1	Upper Storage 408	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 4	63	1	Welding 408	1424	LT24	24	24	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	1.68	0.49	1.19	3,707	1,081	2,625
Morris County Vo Tech NJ	Building 4	64	1	Tool Storage 408b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	65	1	Storage 408c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	66	1	Locker Rm 408d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	67	1	Bathrm 408e	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	6	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	68	1	Office 405f	1424	LT24L14	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	3	2,514	0.07	0.02	0.05	176	51	125
Morris County Vo Tech NJ	Building 4	69	1	Office 405f	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	3	2,514	0.14	0.04	0.10	353	103	250
Morris County Vo Tech NJ	Building 4	70	1	Bathrm 405f	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	71	1	Storage 405g	1444	LT44	3	3	0.1440	0.0420	1x4, 4-Lamp T12	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	7	700	0.42	0.12	0.30	295	86	209
Morris County Vo Tech NJ	Building 4	72	1	Classroom 409	1424	LT24	12	12	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	30	120	TRUE	29	2,200	0.84	0.25	0.60	1,853	541	1,313
Morris County Vo Tech NJ	Building 4	73	1	Classroom 410	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	74	1	Classroom 410	11294T8	LT94	3	3	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	45	120	TRUE	129	1,760	0.75	0.28	0.47	1,313	486	826
Morris County Vo Tech NJ	Building 4	75	1	Classroom 410	1864T8	LT64	5	5	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.83	0.31	0.52	1,459	541	918
Morris County Vo Tech NJ	Building 4	76	1	Classroom 410	11264T8	LT64	2	2	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	77	1	Classroom 410	PL18X2	LKC6NLO	1	1	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	129	1,760	0.04	0.01	0.03	69	22	46
Morris County Vo Tech NJ	Building 4	78	1	Prep Rm 410a	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.11	0.04	0.07	249	90	159
Morris County Vo Tech NJ	Building 4	79	1	Storage 410b	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 4	80	1	Spec Ed Classrm 411	222BX	LT22BX	6	6	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	20	120	TRUE	129	1,760	0.42	0.23	0.19	741	412	329
Morris County Vo Tech NJ	Building 4	81	1	Spec Ed Classrm 411	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	20	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	82	1	Spec Ed Classrm 411	PL18X2	LKC6NLO	2	2	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	129	1,760	0.08	0.03	0.05	137	45	93
Morris County Vo Tech NJ	Building 4	83	1	Classroom 412	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	20	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	84	1	Classroom 412	222BX	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	20	120	TRUE	129	1,760	0.07	0.04	0.03	124	69	55
Morris County Vo Tech NJ	Building 4	85	1	Classroom 412	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 4	86	1	Classroom 412	1434T8	LT34	1	1	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	129	1,760	0.08	0.03	0.05	146	54	92
Morris County Vo Tech NJ	Building 4	87	1	Classroom 412	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	45	120	TRUE	129	1,760	0.06	0.02	0.04	100	36	63
Morris County Vo Tech NJ	Building 4	88	1	Classroom 412	1864T8	LT64	3	3	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 4	89	1	Classroom 412	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	90	1	Classroom 412a	PL18X2	LKC6NLO	2	2	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	129	1,760	0.08	0.03	0.05	137	45	93
Morris County Vo Tech NJ	Building 4	91	1	Classroom 412a	11264T8	LT64	2	2	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	92	1	Classroom 412a	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	45	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 4	93	1	Classroom 412a	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	94	1	Classroom 412b	11294T8	LT94	4	4	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	45	120	TRUE	129	1,760	0.99	0.37	0.63	1,750	649	1,102
Morris County Vo Tech NJ	Building 4	95	1	Classroom 412b	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 4	96	1	Greenhouse 412c	PL26X2	LEDWPMFC03LM	2	2	0.0560	0.0270	CF PL (2) 26w	LED Wallpack, Medium Full Cutoff,		277	TRUE	10	4,380	0.11	0.05	0.06	478	231	248
Morris County Vo Tech NJ	Building 4	97	1	Greenhouse 412c	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	98	1	Storage 412d	2424T8	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.17	0.06	0.11	119	43	76
Morris County Vo Tech NJ	Building 4	99	1	Storage 412e	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 4	100	1	Office 413	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	3	2,514	0.14	0.04	0.10	353	103	250
Morris County Vo Tech NJ	Building 4	101	1	Office 413	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	3	2,514	0.06	0.01	0.05	147	22	125
Morris County Vo Tech NJ	Building 4	102	1	Bathrm 413a	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	103	1	Childcare Classroom 414	2434T8	LT34	37	37	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	3.07	1.14	1.93	6,746	2,500	4,246
Morris County Vo Tech NJ	Building 4	104	1	Childcare Classroom 414	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	105	1	Storage 414d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	106	1	Bathrm 414b	CFL18	LANLO	1	1	0.0180	0.0090	CFL 18w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.02	0.01	0.01	15	8	8
Morris County Vo Tech NJ	Building 4	107	1	Bathrm 414c	CIRC22	LEDDRM01LM	1	1	0.0260	0.0090	Circline 22w	LED 9w Drum		120	TRUE	5	880	0.03	0.01	0.02	22	8	15
Morris County Vo Tech NJ	Building 4	108	1	Childcare Classroom 414a	1424	LT24	11	11	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.77	0.23	0.55	1,699	495	1,203
Morris County Vo Tech NJ	Building 4	109	1	Childcare Classroom 414a	1424EM	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.07	0.02	0.05	615	179	436
Morris County Vo Tech NJ	Building 4	110	1	Storage 414e	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	111	1	Culinary 415	1424	LT24	9	9	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.63	0.18	0.45	1,390	405	985
Morris County Vo Tech NJ	Building 4	112	1	Culinary 415	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	113	1	Culinary 415	CFL23	LANLO	4	4	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	29	2,200	0.09	0.04	0.05	197	77	120
Morris County Vo Tech NJ	Building 4	114	1	Culinary 416	1424	LT24	20	20	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	1.40	0.41	0.99	3,089	901	2,188
Morris County Vo Tech NJ	Building 4	115	1	Culinary 416	1424EM	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.14	0.04	0.10	1,230	359	871
Morris County Vo Tech NJ	Building 4	116	1	Culinary 416	1424	LT24L14	10	10	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.70	0.20	0.50	1,544	450	1,094
Morris County Vo Tech NJ	Building 4	117	1	Culinary 416	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	118	1	Freezer 416a	LED08A	NR	2	2	0.0080	0.0080	LED 8w	will not be Retrofit		120	FALSE	7	700	0.02	0.02	-	11	11	-
Morris County Vo Tech NJ	Building 4	119	1	Boys Lockers 416b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 4	120	1	Boys Bathrm 416c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	121	1	Girls Lockers 416d	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 4	122	1	Girls Lockers 416d	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	29	2,200	0.06	0.01	0.05	129	19	109
Morris County Vo Tech NJ	Building 4	123	1	Girls Bathrm 416e	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	29	2,200	0.06	0.01	0.05	129	19	109
Morris County Vo Tech NJ	Building 4	124	1	Office 416f	2434	LT34	2	2	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	3	2,514	0.22	0.06	0.16	559	154	404
Morris County Vo Tech NJ	Building 4	125	1	Office Bathrm 416f	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	126	1	Vestibule 416g	I60	LANLO	3	3	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	29	2,200	0.18	0.03	0.15	386	58	328
Morris County Vo Tech NJ	Building 4	127	1	Storage 416h	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	128	1	Culinary 416	CFL23	LANLO	8	8	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	29	2,200	0.18	0.07	0.11	395	154	240
Morris County Vo Tech NJ	Building 4	129	1	Dining Hall 416i	2434	LT34	14	14	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	1.56	0.43	1.13	3,423	946	2,477
Morris County Vo Tech NJ	Building 4	130	1	Dining Hall 416i	2434EM	LT34	2	2	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	29	2,200	0.22	0.06	0.16	489	135	354
Morris County Vo Tech NJ	Building 4	131	1	Dining Hall 416i	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	132	1	Dining Hall 416i	I75	LR40NLO	32	32	0.0750	0.0105	Inc 75w	LED Lamp, R/40, NLO		120	TRUE	29	2,200	2.34	0.33	2.01	5,148	721	4,427
Morris County Vo Tech NJ	Building 4	133	1	Dining Hall 416i	I65	LR30NLO	7	7	0.0650	0.0110	Inc 65w	LED Lamp, R/PAR30, NLO		120	TRUE	29	2,200	0.44	0.08	0.37	976	165	811
Morris County Vo Tech NJ	Building 4	133.1	1	Cafeteria	VEND-CD	NR	1	1	0.3390	0.3390	Cold Drink Vending Machine	will not be Retrofit		120	FALSE	1	8,760	0.33	0.33	-	2,895	2,895	-
Morris County Vo Tech NJ	Building 4	133.2	1	Cafeteria	VEND-SM	NR	1	1	0.0410	0.0410	Snack Vending Machine	will not be Retrofit		120	FALSE	1	8,760	0.04	0.04	-	350	350	-
Morris County Vo Tech NJ	Building 4	134	1	Guidance Open Office	222BX	LT22BX	4	4	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.28	0.16	0.12	706	392	314
Morris County Vo Tech NJ	Building 4	135	1	Guidance Open Office	PL42X2	LKC8NLO	6	6	0.0720	0.0400	CF PL (2) 42w	LED Retrofit Can Kit, 8 Inch, Normal Output	32	120	TRUE	3	2,514	0.42	0.23	0.19	1,059	588	471
Morris County Vo Tech NJ	Building 4	136	1	Guidance Open Office	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	137	1	Guidance Open Office	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	138	1	Guidance Office 2	222BX	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.07	0.04	0.03	176	98	78
Morris County Vo Tech NJ	Building 4	139	1	Guidance Office 2	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	140	1	Guidance Office 3	222BX	LT22BX	2	2	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.14	0.08	0.06	353	196	157
Morris County Vo Tech NJ	Building 4	141	1	Guidance Office 3	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	142	1	Guidance Office 4	222BX	LT22BX	2	2	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.14	0.08	0.06	353	196	157
Morris County Vo Tech NJ	Building 4	143	1	Guidance Office 4	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	144	1	Guidance Office 5	222BX	LT22BX	2	2	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.14	0.08	0.06	353	196	157
Morris County Vo Tech NJ	Building 4	145	1	Guidance Office 5	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	146	1	Guidance Office 6	222BX	LT22BX	2	2	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	3	2,514	0.14	0.08	0.06	353	196	157
Morris County Vo Tech NJ	Building 4	147	1	Guidance Office 6	222BXEM	LT22BX	1	1	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	32	120	TRUE	1	8,760	0.07	0.04	0.03	615	342	273
Morris County Vo Tech NJ	Building 4	148	1	Nurse's Office	2434	LT34	4	4	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps	23	120	TRUE	3	2,514	0.44	0.12	0.32	1,118	309	809
Morris County Vo Tech NJ	Building 4	149	1	Nurse's Exam Rm	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps	23	120	TRUE	3	2,514	0.28	0.08	0.20	706	206	500

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 4	150	1	Nurse's Exam Rm	I60	LANLO	3	3	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	3	2,514	0.18	0.03	0.15	441	66	375
Morris County Vo Tech NJ	Building 4	151	1	Nurse's Bathrm	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	3	2,514	0.06	0.01	0.05	147	22	125
Morris County Vo Tech NJ	Building 4	152	1	Classroom 418	11264T8	LT64	6	6	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.99	0.37	0.63	1,750	649	1,102
Morris County Vo Tech NJ	Building 4	153	1	Classroom 418	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	154	1	Classroom 418	1864T8	LT64	4	4	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.66	0.25	0.42	1,167	432	734
Morris County Vo Tech NJ	Building 4	155	1	Storage 418a	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	156	1	Janitorial 10	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 4	157	1	Classroom 417	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 4	158	1	Classroom 417	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	159	1	Classroom 417	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 4	160	1	Classroom 417	1434T8	LT34	1	1	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	45	120	TRUE	129	1,760	0.08	0.03	0.05	146	54	92
Morris County Vo Tech NJ	Building 4	161	1	Classroom 417	PL42X2	LKC8NLO	2	2	0.0720	0.0400	CF PL (2) 42w	LED Retrofit Can Kit, 8 Inch, Normal Output	45	120	TRUE	129	1,760	0.14	0.08	0.06	247	137	110
Morris County Vo Tech NJ	Building 4	162	1	Storage/ Electric 417a	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.14	0.04	0.10	98	29	70
Morris County Vo Tech NJ	Building 4	163	1	Bathroom, Men's	LED24	NR	2	2	0.0240	0.0240	LED 24w	will not be Retrofit		120	FALSE	6	2,200	0.05	0.05	-	103	103	-
Morris County Vo Tech NJ	Building 4	164	1	Bathroom, Men's	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	165	1	Bathroom, Women's	LED24	NR	2	2	0.0240	0.0240	LED 24w	will not be Retrofit		120	FALSE	6	2,200	0.05	0.05	-	103	103	-
Morris County Vo Tech NJ	Building 4	166	1	Bathroom, Women's	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	167	1	Teachers Lounge	2434	LT34	9	9	0.1140	0.0315	2x4, 3-Lamp T12	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	3	2,514	1.00	0.28	0.72	2,515	695	1,820
Morris County Vo Tech NJ	Building 4	168	1	Art Classroom 406	1424	LT24	51	51	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	3.58	1.04	2.54	7,876	2,297	5,579
Morris County Vo Tech NJ	Building 4	169	1	Art Classroom 406	1844	LT44	4	4	0.1440	0.0420	1x8, 4-Lamp T12 4'	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	29	2,200	0.56	0.16	0.40	1,236	360	875
Morris County Vo Tech NJ	Building 4	170	1	Art Classroom 406	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	171	1	Storage 406a	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.28	0.08	0.20	618	180	438
Morris County Vo Tech NJ	Building 4	172	1	Office 406b	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 4	173	1	Girls Bathrm 406c	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	5	880	0.07	0.02	0.05	62	18	44
Morris County Vo Tech NJ	Building 4	174	1	Boys Bathrm 406d	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	5	880	0.07	0.02	0.05	62	18	44
Morris County Vo Tech NJ	Building 4	175	1	Media Ctr 407	1424	LT24	38	38	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	30	2,966	2.67	0.78	1.89	7,912	2,308	5,604
Morris County Vo Tech NJ	Building 4	176	1	Media Ctr 407	1424EM	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.28	0.08	0.20	2,460	717	1,742
Morris County Vo Tech NJ	Building 4	177	1	Office 407a	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	178	1	Faculty Bathrm 407b	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.07	0.02	0.05	154	45	109
Morris County Vo Tech NJ	Building 4	179	1	Office 407c	1424	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	29	2,200	0.14	0.04	0.10	309	90	219
Morris County Vo Tech NJ	Building 4	180	1	Bathrm 407c	I60	LANLO	1	1	0.0600	0.0090	Inc 60w	LED Lamp, A-Line, NLO		120	TRUE	5	880	0.06	0.01	0.05	51	8	44
Morris County Vo Tech NJ	Building 4	181	1	Conference Rm 407d	1424	LT24	5	5	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	16	720	0.35	0.10	0.25	253	74	179
Morris County Vo Tech NJ	Building 4	182	1	Storage 13	1424	LT24	3	3	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.21	0.06	0.15	147	43	104
Morris County Vo Tech NJ	Building 4	183	1	Vending 14	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.07	0.02	0.05	336	98	238
Morris County Vo Tech NJ	Building 4	184	1	Storage 15	1424	LT24	5	5	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.35	0.10	0.25	246	72	174
Morris County Vo Tech NJ	Building 4	185	1	Telephone Rm 16	1424	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.07	0.02	0.05	49	14	35
Morris County Vo Tech NJ	Building 4	186	1	Electrical Rm 17	1424	LT24	4	4	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.28	0.08	0.20	197	57	139
Morris County Vo Tech NJ	Building 4	187	1	Electrical Rm 17	1424EM	LT24	1	1	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.07	0.02	0.05	615	179	436
Morris County Vo Tech NJ	Building 4	188	1	Electrical Rm 17	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 4	189	1	Boiler Rm 18	1424	LT24	6	6	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.42	0.12	0.30	295	86	209
Morris County Vo Tech NJ	Building 4	190	1	Boiler Rm 18	1424EM	LT24	2	2	0.0720	0.0210	1x4, 2-Lamp T12	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.14	0.04	0.10	1,230	359	871
Morris County Vo Tech NJ	Building 4	191	1	Courtyard	LEDCORNCOB	NR	4	4	0.0500	0.0500	LED 50w	will not be Retrofit		120	FALSE	10	4,380	0.20	0.20	-	854	854	-
Morris County Vo Tech NJ	Building 4	192	1	Hallway H1	LED22	NR	12	12	0.0220	0.0220	LED 22w	will not be Retrofit		120	FALSE	9	4,786	0.26	0.26	-	1,232	1,232	-
Morris County Vo Tech NJ	Building 4	193	1	Hallway H1	LED22EM	NR	6	6	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	194	1	Hallway H1	K-LED	NR	6	6	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	205	205	-
Morris County Vo Tech NJ	Building 4	195	1	Hallway H1	1824	LT24	4	4	0.0720	0.0210	1x8, 2-Lamp T12 4'	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.28	0.08	0.20	1,344	392	952
Morris County Vo Tech NJ	Building 4	196	1	Hallway H1	1824	LT24	8	8	0.0720	0.0210	1x8, 2-Lamp T12 4'	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	9	4,786	0.56	0.16	0.40	2,688	784	1,904
Morris County Vo Tech NJ	Building 4	197	1	Main Entry	CFL23	LANLO	3	3	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	9	4,786	0.07	0.03	0.04	322	126	196
Morris County Vo Tech NJ	Building 4	198	1	Main Entry Canopy	CFL23	LANLO	4	4	0.0230	0.0090	CFL SI 23w	LED Lamp, A-Line, NLO		120	TRUE	9	4,786	0.09	0.04	0.05	429	168	261
Morris County Vo Tech NJ	Building 4	199	1	Hallway H2	LED22	NR	6	6	0.0220	0.0220	LED 22w	will not be Retrofit		120	FALSE	9	4,786	0.13	0.13	-	616	616	-
Morris County Vo Tech NJ	Building 4	200	1	Hallway H2	LED22EM	NR	3	3	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	201	1	Hallway H2	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	202	1	Hallway H3	LED22	NR	12	12	0.0220	0.0220	LED 22w	will not be Retrofit		120	FALSE	9	4,786	0.26	0.26	-	1,232	1,232	-
Morris County Vo Tech NJ	Building 4	203	1	Hallway H3	LED22EM	NR	8	8	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	204	1	Hallway H3	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 4	205	1	Hallway H4	LED22	NR	6	6	0.0220	0.0220	LED 22w	will not be Retrofit		120	FALSE	9	4,786	0.13	0.13	-	616	616	-
Morris County Vo Tech NJ	Building 4	206	1	Hallway H4	LED22EM	NR	5	5	-	-	No Retrofit	will not be Retrofit		120	FALSE	1	8,760	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 4	207	1	Hallway H4	K-LED	NR	2	2	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	68	68	-
Morris County Vo Tech NJ	Building 4	208	Ext	Exterior Cylinder Storage	1424T8	LT24	4	4	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.23	0.08	0.14	158	57	101
Morris County Vo Tech NJ	Building 4	209		Storage /roof Access Area	VEND-CD	NR	1	1	0.3390	0.3390	Cold Drink Vending Machine	will not be Retrofit		120	FALSE	1	8,760	0.33	0.33	-	2,895	2,895	-
Morris County Vo Tech NJ	Building 4	210		Storage /roof Access Area	VEND-SM	NR	1	1	0.0410	0.0410	Snack Vending Machine	will not be Retrofit		120	FALSE	1	8,760	0.04	0.04	-	350	350	-
Morris County Vo Tech NJ	Building 5	1	1	Bay 1	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	2	1	Bay 1	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	3	1	Bay 1	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 5	4	1	Bay 2	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	5	1	Bay 2	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	6	1	Bay 2	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 5	7	1	Bay 3	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	8	1	Bay 3	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	9	1	Bay 3	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 5	10	1	Bay 4	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	11	1	Bay 4	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	12	1	Bay 4	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 5	13	1	Bay 5	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	14	1	Bay 5	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	15	1	Bay 5	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 5	16	1	Bay 6	1828	LED18SLNLO	6	6	0.1260	0.0606	1x8, 2-Lamp T12	LED 1x8 Lensed Strip	27	120	TRUE	7	700	0.74	0.35	0.38	516	248	268
Morris County Vo Tech NJ	Building 5	17	1	Bay 6	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 5	18	1	Bay 6	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 6	1	2	Classroom 611	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	2	2	Classroom 611	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	55	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	3	2	Classroom 611	11264T8	LT64	2	2	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	4	2	Classroom 612	11264T8	LT64	2	2	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	5	2	Classroom 612	1844T8	LT44	2	2	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	55	120	TRUE	129	1,760	0.22	0.08	0.14	384	144	240
Morris County Vo Tech NJ	Building 6	6	2	Classroom 612	11294T8	LT94	1	1	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	55	120	TRUE	129	1,760	0.25	0.09	0.16	438	162	275
Morris County Vo Tech NJ	Building 6	7	2	Classroom 612	1864T8	LT64	1	1	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	8	2	Classroom 613	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	55	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	9	2	Classroom 613	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	10	2	Classroom 613	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	11	2	Classroom 613	1844T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	12	2	Classroom 614	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	13	2	Classroom 614	11294T8	LT94	3	3	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.75	0.28	0.47	1,313	486	826
Morris County Vo Tech NJ	Building 6	14	2	Classroom 614	1844T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	15	2	Storage 614/615	2424T8	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	51	120	TRUE	107	400	0.17	0.06	0.11	68	25	43
Morris County Vo Tech NJ	Building 6	16	2	Classroom 615	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	17	2	Classroom 615	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	18	2	Classroom 615	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	19	2	Classroom 615	1844T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	20	2	Classroom 616	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	21	2	Classroom 616	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	22	2	Classroom 616	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	23	2	Classroom 616	1844T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	24	2	Classroom 617	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	25	2	Classroom 617	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	26	2	Classroom 617	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	27	2	Classroom 617	1844T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	28	2	Classroom 618	1864T8	LT64	2	2	0.1700	0.0630	1x8, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	29	2	Classroom 618	11294T8	LT94	2	2	0.2550	0.0945	1x12, 9-Lamp T8	LED Int. Driver Lamps, (9) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 6	30	2	Classroom 618	11264T8	LT64	1	1	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	31	2	Classroom 618	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	32	2	Conference Rm 619	2434T8	LT34	5	5	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	55	120	TRUE	16	720	0.41	0.15	0.26	298	111	188
Morris County Vo Tech NJ	Building 6	33	2	Storage Rm 619a	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	38	120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	34	2	Women's Bathrm 620	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	38	120	TRUE	106	1,760	0.08	0.03	0.05	146	54	92
Morris County Vo Tech NJ	Building 6	35	2	Women's Bathrm 620	2434T8BB	LT34BB	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	38	120	TRUE	106	1,760	0.17	0.06	0.10	292	108	184
Morris County Vo Tech NJ	Building 6	36	2	Men's Bathrm 621	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	38	120	TRUE	106	1,760	0.08	0.03	0.05	146	54	92
Morris County Vo Tech NJ	Building 6	37	2	Men's Bathrm 621	2434T8BB	LT34BB	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	38	120	TRUE	106	1,760	0.08	0.03	0.05	146	54	92
Morris County Vo Tech NJ	Building 6	38	2	Janitorial 622	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	39	2	Roof Top Access	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	40	2	Boiler Rm 623	1424T8	LT24	9	9	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.51	0.18	0.32	356	129	227
Morris County Vo Tech NJ	Building 6	41	2	Boiler Rm 623	S150	LEDWPFC05LM	3	3	0.1880	0.0430	HPS 150w	LED Wallpack, Full Cutoff, 5,000 Lumens		120	TRUE	10	4,380	0.55	0.13	0.42	2,409	551	1,858
Morris County Vo Tech NJ	Building 6	42	2	Boiler Rm 623	M175	LEDWPFC05LM	1	1	0.2100	0.0430	MH 175w	LED Wallpack, Full Cutoff, 5,000 Lumens		120	TRUE	10	4,380	0.20	0.04	0.16	897	184	713
Morris County Vo Tech NJ	Building 6	43	2	Hallway H1	2424T8	LT24	4	4	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	25	120	TRUE	9	4,786	0.23	0.08	0.14	1,083	392	691
Morris County Vo Tech NJ	Building 6	44	2	Hallway H1	2424T8EMBB	LT24BB	4	4	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB	25	120	TRUE	1	8,760	0.23	0.08	0.14	1,982	717	1,264
Morris County Vo Tech NJ	Building 6	45	2	Hallway H1	1414T5	LT14T5	16	16	0.0330	0.0130	1x4, 1-Lamp T5	LED Linear Lamp Kit, (1) 4' Lamp T5	25	120	TRUE	9	4,786	0.51	0.20	0.31	2,464	971	1,493
Morris County Vo Tech NJ	Building 6	46	2	Hallway H1	PL42	LKC8NLO	27	27	0.0460	0.0400	CF PL 42w	LED Retrofit Can Kit, 8 Inch, Normal Output	25	120	TRUE	9	4,786	1.21	1.05	0.16	5,796	5,040	756
Morris County Vo Tech NJ	Building 6	47	2	Hallway H1	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-
Morris County Vo Tech NJ	Building 6	48	2	Stairwell A	2434T8EMBB	LT34BB	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	12	120	TRUE	1	8,760	0.17	0.06	0.10	1,452	538	914
Morris County Vo Tech NJ	Building 6	49	2	Stairwell A	LED24	NR	1	1	0.0240	0.0240	LED 24w	will not be Retrofit	12	120	FALSE	9	4,786	0.02	0.02	-	112	112	-
Morris County Vo Tech NJ	Building 6	50	2	Stairwell A	FE	NR	1	1	-	-	Frog Eye - Emergency Fixture	will not be Retrofit		120	FALSE	98	50	-	-	-	-	-	-
Morris County Vo Tech NJ	Building 6	51	2	Stairwell A	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 6	52	2	Stairwell B	2434T8EMBB	LT34BB	3	3	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	12	120	TRUE	1	8,760	0.25	0.09	0.16	2,178	807	1,371
Morris County Vo Tech NJ	Building 6	53	2	Stairwell B	PL42	LKC6NLO	2	2	0.0460	0.0130	CF PL 42w	LED Retrofit Can Kit, 6 Inch, Normal Output	25	120	TRUE	9	4,786	0.09	0.03	0.06	429	121	308
Morris County Vo Tech NJ	Building 6	54	2	Stairwell B	K-LED-FE	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 6	55	1	Classroom 601	1434T8	LT34	3	3	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.25	0.09	0.16	438	162	275
Morris County Vo Tech NJ	Building 6	56	1	Classroom 601	11264T8	LT64	4	4	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.66	0.25	0.42	1,167	432	734
Morris County Vo Tech NJ	Building 6	57	1	Classroom 601	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	50	120	TRUE	129	1,760	0.06	0.02	0.04	100	36	63
Morris County Vo Tech NJ	Building 6	58	1	Prep Rm 601/602	222BX	LT22BX	3	3	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	40	120	TRUE	129	1,760	0.21	0.12	0.09	371	206	165
Morris County Vo Tech NJ	Building 6	59	1	Classroom 602	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	60	1	Classroom 602	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	61	1	Classroom 602	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	62	1	Classroom 603	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	63	1	Classroom 603	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	64	1	Classroom 603	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	65	1	Prep Rm 603/604	222BX	LT22BX	3	3	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	40	120	TRUE	129	1,760	0.21	0.12	0.09	371	206	165
Morris County Vo Tech NJ	Building 6	66	1	Classroom 604	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	67	1	Classroom 604	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	68	1	Classroom 604	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	69	1	Classroom 605	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	70	1	Classroom 605	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	71	1	Classroom 605	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	72	1	Prep Rm 605/606	222BX	LT22BX	3	3	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	40	120	TRUE	129	1,760	0.21	0.12	0.09	371	206	165
Morris County Vo Tech NJ	Building 6	73	1	Classroom 606	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	74	1	Classroom 606	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	75	1	Classroom 606	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	76	1	Classroom 607	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	77	1	Classroom 607	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	78	1	Classroom 607	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	79	1	Prep Rm 607/608	222BX	LT22BX	3	3	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	40	120	TRUE	129	1,760	0.21	0.12	0.09	371	206	165
Morris County Vo Tech NJ	Building 6	80	1	Classroom 608	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	81	1	Classroom 608	11264T8	LT64	3	3	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.50	0.18	0.31	875	324	551
Morris County Vo Tech NJ	Building 6	82	1	Classroom 608	1B44T8	LT44	1	1	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.11	0.04	0.07	192	72	120
Morris County Vo Tech NJ	Building 6	83	1	Vending 609	2424T8	LT24	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	15	120	TRUE	3	2,514	0.06	0.02	0.04	142	51	91
Morris County Vo Tech NJ	Building 6	84	1	Janitorial 610	PL32X2	LEDDRM01LM	1	1	0.0720	0.0090	CF PL (2) 32w	LED 9w Drum		120	TRUE	7	700	0.07	0.01	0.06	49	6	43

Site Name	Building Name	Index	Floor	Location	Existing Code	Proposed Code	Existing Qty	Proposed Qty	Existing kW	Proposed kW	Existing Description	Proposed Description	Existing Foot Candles	Volts	Included in Project	Hour Code	Total Hours	Total Pre kW	Total Post kW	Total Saved kW	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech NJ	Building 6	85	1	Gymnasium	BIAXX8DSBB	LT82BB-BIAX	6	6	0.2880	0.1600	2x2,8-Lamp Biax,	LED Int. Driver Lamp, (8) Biax Lamps		120	TRUE	22	3,553	1.68	0.94	0.75	5,986	3,326	2,660
Morris County Vo Tech NJ	Building 6	86	1	Gymnasium	BIAXX8DS	LT82-BIAX	18	18	0.2880	0.1600	2x2,8-Lamp Biax,	LED Int. Driver Lamp, (8) Biax Lamps		120	TRUE	22	3,553	5.05	2.81	2.25	17,958	9,977	7,981
Morris County Vo Tech NJ	Building 6	87	1	Gymnasium	K-LED	NR	4	4	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	137	137	-
Morris County Vo Tech NJ	Building 6	88	1	Gymnasium	PL18X2	LKC6NLO	2	2	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	22	3,553	0.08	0.03	0.05	277	90	187
Morris County Vo Tech NJ	Building 6	89	1	Gym Storage G2	1424T8	LT24	2	2	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.11	0.04	0.07	79	29	51
Morris County Vo Tech NJ	Building 6	90	1	Gym Storage G3	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	90.1	1	Gymnasium	VEND-SM	NR	1	1	0.0410	0.0410	Snack Vending Machine	will not be Retrofit		120	FALSE	1	8,760	0.04	0.04	-	350	350	-
Morris County Vo Tech NJ	Building 6	91	1	Theatre Arts	2464T8	LT64	6	6	0.1700	0.0630	2x4, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps		120	TRUE	30	2,966	0.99	0.37	0.63	2,950	1,093	1,857
Morris County Vo Tech NJ	Building 6	92	1	Theatre Arts	HAL50	NR	9	9	0.0500	0.0500	HAL 50w	will not be Retrofit		120	FALSE	98	50	0.44	0.44	-	22	22	-
Morris County Vo Tech NJ	Building 6	93	1	Theatre Storage	2434T8	LT34	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	30	2,966	0.17	0.06	0.10	492	182	309
Morris County Vo Tech NJ	Building 6	94	1	Theatre Lockers	2434T8	LT34	1	1	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	9	4,786	0.08	0.03	0.05	397	147	250
Morris County Vo Tech NJ	Building 6	95	1	Theatre Back Hall	PL18X2	LKC6NLO	6	6	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	9	4,786	0.23	0.08	0.16	1,120	364	756
Morris County Vo Tech NJ	Building 6	96	1	Theatre Back Hall	LED24	NR	1	1	0.0240	0.0240	LED 24w	will not be Retrofit	12	120	FALSE	9	4,786	0.02	0.02	-	112	112	-
Morris County Vo Tech NJ	Building 6	97	1	Dance Lockers	2434T8	LT34	2	2	0.0850	0.0315	2x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps		120	TRUE	9	4,786	0.17	0.06	0.10	793	294	499
Morris County Vo Tech NJ	Building 6	98	1	Dance Studio	2464T8	LT64	9	9	0.1700	0.0630	2x4, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps		120	TRUE	29	2,200	1.49	0.55	0.94	3,282	1,216	2,066
Morris County Vo Tech NJ	Building 6	99	1	Ettc Lab E1	1434T8	LT34	4	4	0.0850	0.0315	1x4, 3-Lamp T8	LED Int. Driver Lamps, (3) 4' Lamps	50	120	TRUE	129	1,760	0.33	0.12	0.21	583	216	367
Morris County Vo Tech NJ	Building 6	100	1	Ettc Lab E1	11264T8	LT64	4	4	0.1700	0.0630	1x12, 6-Lamp T8	LED Int. Driver Lamps, (6) 4' Lamps	50	120	TRUE	129	1,760	0.66	0.25	0.42	1,167	432	734
Morris County Vo Tech NJ	Building 6	101	1	Ettc Lab E1	1844T8	LT44	4	4	0.1120	0.0420	1x8, 4-Lamp T18 4'	LED Int. Driver Lamps, (4) 4' Lamps	50	120	TRUE	129	1,760	0.44	0.16	0.27	769	288	480
Morris County Vo Tech NJ	Building 6	102	1	Men's Bathrm M1	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	38	120	TRUE	106	1,760	0.11	0.04	0.07	199	72	127
Morris County Vo Tech NJ	Building 6	103	1	Men's Bathrm M1	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB	38	120	TRUE	106	1,760	0.06	0.02	0.04	100	36	63
Morris County Vo Tech NJ	Building 6	104	1	Women's Bathrm W1	2424T8	LT24	2	2	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	38	120	TRUE	106	1,760	0.11	0.04	0.07	199	72	127
Morris County Vo Tech NJ	Building 6	105	1	Women's Bathrm W1	2424T8BB	LT24BB	1	1	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB	38	120	TRUE	106	1,760	0.06	0.02	0.04	100	36	63
Morris County Vo Tech NJ	Building 6	106	1	Electrical Rm E2	2424T8	LT24	4	4	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	38	120	TRUE	106	1,760	0.23	0.08	0.14	398	144	254
Morris County Vo Tech NJ	Building 6	107	1	Hallway H2	2424T8	LT24	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	25	120	TRUE	9	4,786	0.17	0.06	0.11	812	294	518
Morris County Vo Tech NJ	Building 6	108	1	Hallway H2	2424T8EMBB	LT24BB	3	3	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB	25	120	TRUE	1	8,760	0.17	0.06	0.11	1,486	538	948
Morris County Vo Tech NJ	Building 6	109	1	Hallway H2	K-LED	NR	3	3	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.01	0.01	-	102	102	-
Morris County Vo Tech NJ	Building 6	110	1	Hallway H2	PL18X2	LKC6NLO	5	5	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	9	4,786	0.20	0.06	0.13	933	303	630
Morris County Vo Tech NJ	Building 6	111	1	Hallway H2	1444T8	LT44	1	1	0.1120	0.0420	1x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	9	4,786	0.11	0.04	0.07	523	196	327
Morris County Vo Tech NJ	Building 6	112	1	Hallway H3	2424T8	LT24	5	5	0.0580	0.0210	2x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps	25	120	TRUE	9	4,786	0.28	0.10	0.18	1,353	490	863
Morris County Vo Tech NJ	Building 6	113	1	Hallway H3	2424T8EMBB	LT24BB	5	5	0.0580	0.0210	2x4, 2-Lamp T8	LED Linear Lamp Kit, (2) 4' Lamps, BB	25	120	TRUE	1	8,760	0.28	0.10	0.18	2,477	897	1,580
Morris County Vo Tech NJ	Building 6	114	1	Hallway H3	PL18X2	LKC6NLO	26	26	0.0400	0.0130	CF PL (2) 18w	LED Retrofit Can Kit, 6 Inch, Normal Output		120	TRUE	9	4,786	1.01	0.33	0.68	4,853	1,577	3,276
Morris County Vo Tech NJ	Building 6	115	1	Hallway H3	1444T8	LT44	4	4	0.1120	0.0420	1x4, 4-Lamp T8	LED Int. Driver Lamps, (4) 4' Lamps		120	TRUE	9	4,786	0.44	0.16	0.27	2,091	784	1,307
Morris County Vo Tech NJ	Building 6	116	1	Hallway H3	K-LED	NR	4	4	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.02	0.02	-	137	137	-
Morris County Vo Tech NJ	Building 6	117	1	Elevator Control Rm	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	118	1	Elevator	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	1	8,760	0.06	0.02	0.04	495	179	316
Morris County Vo Tech NJ	Building 6	119	1	Entrance Vest	K-LED	NR	1	1	0.0040	0.0040	Exit Sign - LED	will not be Retrofit		120	FALSE	1	8,760	0.00	0.00	-	34	34	-
Morris County Vo Tech NJ	Building 6	120	1	Entrance Vest	222BX	LT22BX	2	2	0.0720	0.0400	2x2,2-Lamp Biax,	LED Int. Driver Lamp, (2) Biax Lamps	40	120	TRUE	9	4,786	0.14	0.08	0.06	672	373	299
Morris County Vo Tech NJ	Building 6	121	1	Entrance Vest	LED08A	NR	2	2	0.0080	0.0080	LED 8w	will not be Retrofit	40	120	FALSE	9	4,786	0.02	0.02	-	75	75	-
Morris County Vo Tech NJ	Building 6	122	1	Sprinkler Rm	1424T8	LT24	1	1	0.0580	0.0210	1x4, 2-Lamp T8	LED Int. Driver Lamps, (2) 4' Lamps		120	TRUE	7	700	0.06	0.02	0.04	40	14	25
Morris County Vo Tech NJ	Building 6	123	Ext	Exterior Code A	M175	LEDWPFC05LMPH	7	7	0.2100	0.0430	MH 175w	LED Wallpack, Full Cutoff, 5,000 Lumens, PH		120	TRUE	10	4,380	1.43	0.29	1.14	6,278	1,285	4,992
Morris County Vo Tech NJ	Building 6	124	Ext	Exterior Code B	PL42X2	LEDWPFC05LMPH	2	2	0.0720	0.0430	CF PL (2) 42w	LED Wallpack, Full Cutoff, 5,000 Lumens, PH		120	TRUE	10	4,380	0.14	0.08	0.06	615	367	248
Morris County Vo Tech NJ	Building 6	125	Ext	Exterior Code C	PL42X2	LEDWPFC05LMPH	3	3	0.0720	0.0430	CF PL (2) 42w	LED Wallpack, Full Cutoff, 5,000 Lumens, PH		120	TRUE	10	4,380	0.21	0.13	0.08	922	551	372
Morris County Vo Tech NJ	Building 7	1	1	Guard Shack	I65	LR30NLO	2	2	0.0650	0.0110	Inc 65w	LED Lamp, R/PAR30, NLO		120	TRUE	3	2,514	0.13	0.02	0.11	319	54	265
						Fixtures Included for Upgraded	**1,848**	**1,848**									**3,859**	**198**	**95**	**103**	**492,922**	**242,745**	**250,178**
						Total Fixtures Identified	**2,409**	**2,409**															

Site Name	Building Name	Index	Floor	Location	Control Qty	Control Code	Total Proposed Load	Proposed Control Description	Hour Code	Proposed Control Load Reduction	Proposed Control Hours Reduction	Total Hours	Total kWh Existing	Total kWh Proposed	Total kWh Saved
Morris County Vo Tech	Building 1	2	1	Superintendent	1	OSC-WL	0.1890	Occ. Sensor, 360 Ceiling, 1 Head,	3	100%	31%	2,514	475	328	147
Morris County Vo Tech	Building 1	12	1	Business Office	1	OSC2-WL	0.3150	Occ. Sensor, 360 Ceiling, 2 Head,	3	100%	31%	2,514	792	546	245
Morris County Vo Tech	Building 1	23	1	Classroom 104	1	OSC2-WL	0.4410	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	970	728	243
Morris County Vo Tech	Building 1	25	1	Classroom 105	1	OSC2-WL	0.4730	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	1,041	780	260
Morris County Vo Tech	Building 1	35	1	Store 109	1	OSC2-WL	0.7880	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	1,734	1,300	433
Morris County Vo Tech	Building 1	54	1	Office 26	1	OSWDT	0.1260	Occ. Sensor, Wallswitch, DT	3	100%	31%	2,514	317	219	98
Morris County Vo Tech	Building 1	99	1	Classroom 129	1	OSC2-WL	0.3990	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	878	658	219
Morris County Vo Tech	Building 1	105	1	Cosmotology	1	OSC2-WL	0.6510	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	1,432	1,074	358
Morris County Vo Tech	Building 1	111	1	Cadd	1	OSC2-WL	0.3780	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	832	624	208
Morris County Vo Tech	Building 1	123	1	Cosmotology	1	OSC2-WL	0.6300	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	1,386	1,040	347
Morris County Vo Tech	Building 1	128	1	Cosmotology	1	OSC2-WL	0.6300	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	1,386	1,040	347
Morris County Vo Tech	Building 2	11	1	Office Area 205	1	OSC2-WL	0.3150	Occ. Sensor, 360 Ceiling, 2 Head,	3	100%	31%	2,514	792	546	245
Morris County Vo Tech	Building 2	23	1	Classrm 203	1	OSC2-WL	0.4180	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	920	690	230
Morris County Vo Tech	Building 2	27	1	Classrm 204	1	OSC2-WL	0.4190	Occ. Sensor, 360 Ceiling, 2 Head,	29	100%	25%	2,200	922	691	230
Morris County Vo Tech	Building 2	34	1	Classrm 205	1	OSC3-WL	0.6150	Occ. Sensor, 360 Ceiling, 3 Head,	29	100%	25%	2,200	1,353	1,015	338
Morris County Vo Tech	Building 4	1	1	Classroom	1	OSC-WL	0.2520	Occ. Sensor, 360 Ceiling, 1 Head,	29	100%	25%	2,200	554	416	139
Morris County Vo Tech	Building 4	103	1	Childcare	1	OSC5-WL	1.1660	Occ. Sensor, 360 Ceiling, 5 Head,	29	100%	25%	2,200	2,565	1,924	641
Morris County Vo Tech	Building 4	134	1	Guidance Open	1	OSFL-WL	0.4000	Occ. Sensor, Flood, 1 Head WV,	3	100%	31%	2,514	1,006	694	312
Morris County Vo Tech	Building 4	167	1	Teachers	1	OSC-WL	0.2830	Occ. Sensor, 360 Ceiling, 1 Head,	3	100%	31%	2,514	711	491	221
Morris County Vo Tech	Building 4	168	1	Art Classroom	1	OSFL3-WL	1.2390	Occ. Sensor, Flood, 3 Head WV,	29	100%	25%	2,200	2,726	2,044	681
Morris County Vo Tech	Building 4	175	1	Media Ctr 407	1	OSFL4-WL	0.7980	Occ. Sensor, Flood, 4 Head WV,	29	100%	25%	2,200	1,756	1,317	439

Morris County Vo-Tech
Exhibit D
ECM 1B Destratification Fans
De-stratifcation fans

ECM DESCRIPTION

Install de-stratification fans in large open ares. Fans will push and hold hot air down to reduce heating losses through the roof and upper section of the outside walls due to reducing the indoor temperature in these sections above the fan.

DATA / ASSUMPTIONS

Heating Hours	3,863	Hours
Roof - R Value (Assume between 1-2" insulation)	9.0	ft2-Deg F-hr/BTU
Wall - R Value (Assume 1/2" Wall Board, 8" LWCC, 4" Brick)	4.5	ft2-Deg F-hr/BTU
Window U Value Single Pane	1.2	Btu/ft2-Deg F-hr
Window U Value Double Pane	1.2	Btu/ft2-Deg F-hr

*Heating efficiency of de-stratification fans assumed at 60%

MEASUREMENT AND VERIFICATION

Option A: Pre M&V: Verify parameters used in engineering calculations with site conditions. Post M&V: Verify that systems are installed as specified to match the savings assumptions. Energy: Verify savings based on programmed parameters and engineering calculations

COMMISSIONING

Verify that the installed fans operate. Install clock meter on fans to verify that fans are running 24/7 during heating season

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Fuel savings recovery factor is conservatively set for 0 for the ECM due to the uncertainity in consistency of temperature difference between room and upper level temperatures, electric penalties recovery factor is at 0.

FORMULA

$$W_{TOTAL} = W_{FAN} \cdot q \cdot t_{FAN}$$

$$Q_{SAVINGS} = Q_{TOTAL} \cdot \mu$$

$$Q_{TOTAL} = Q_{WALL} + Q_{ROOF} + Q_{WIN}$$

$$Q_{WALL} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{UNOCC})$$

$$Q_{WIN} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{UNOCC})$$

$$Q_{ROOF} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{UNOCC})$$

Variable	Units	Description
$Q_{SAVINGS}$	Therms	Annual thermal savings
$\sum_{-5}^{60}$	-	Summation of all bins from -5°F to 60°F
μ	%	Diversity factor of de-stratification fans (25% - 50%)
Q_{TOTAL}	btu	Total heat loss
Q_{WALL}	btu	Heat loss through wall (above de-stratification fan)
Q_{ROOF}	btu	Heat loss through roof
Q_{WIN}	btu	Heat loss through windows (above de-stratification fan)
T_{BIN}	°F	Temperature of respective bin
T_{OCC}	°F	Existing temperature of space during occupied hours
T_{UNOCC}	°F	Existing temperature of space during unoccupied hours
T_{STRAT}	°F	Existing stratified temperature above de-stratification fan) during all heating hours
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Unoccupied Bin Hours in respective temperature bin
A_{WALL}	ft^2	Exposed wall area adove de-stratification fan
A_{ROOF}	ft^2	Exposed roof area adove de-stratification fan
A_{WINDOW}	ft^2	Exposed window area adove de-stratification fan
U_{WALL}	btu / ft^2 / °F	U-factor of wall
U_{ROOF}	btu / ft^2 / °F	U-factor of roof
U_{WIN}	btu / ft^2 / °F	U-factor of windows
W_{TOTAL}	kWh	Annual electrical consumption of fans
q	-	Quantity of fans
W_{FAN}	kW	Input kW of fan
t_{FAN}	Hrs	Annual run time of de-stratification fan (annual heating hours)

Morris County Vo-Tech
Exhibit D
ECM 1B Destratification Fans
De-stratifcation fans

ECM DESCRIPTION

Install de-stratification fans in large open ares. Fans will push and hold hot air down to reduce heating losses through the roof and upper section of the outside walls due to reducing the indoor temperature in these sections above the fan.

DATA / ASSUMPTIONS

Heating Hours	3,863	Hours
Roof - R Value (Assume 1" insulation)	4.3	ft2-Deg F-hr/BTU
Wall - R Value (Assume 4" Common Brick, Dark Color, Lightweight 8"' Block, Hollow)	3.7	ft2-Deg F-hr/BTU
Window U Value Single Pane	1.2	Btu/ft2-Deg F-hr
Window U Value Double Pane	0.29	Btu/ft2-Deg F-hr

*Heating efficiency of de-stratification fans assumed at 60%

MEASUREMENT AND VERIFICATION

Option A: Pre M&V: Verify parameters used in engineering calculations with site conditions. Post M&V: Verify that systems are installed as specified to match the savings assumptions. Energy: Verify savings based on programmed parameters and engineering calculations

COMMISSIONING

Verify that the installed fans operate. Install clock meter on fans to verify that fans are running 24/7 during heating season

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Fuel savings recovery factor is conservatively set for 0 for the ECM due to the uncertainity in consistency of temperature difference between room and upper level temperatures, electric penalties recovery factor is at 0.

FORMULA

$W_{TOTAL} = W_{FAN} \cdot q \cdot t_{FAN}$

$Q_{SAVINGS} = Q_{TOTAL} \cdot \mu$

$Q_{TOTAL} = Q_{WALL} + Q_{ROOF} + Q_{WIN}$

$Q_{WALL} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{WALL} \cdot U_{WALL} \cdot t_{UNOCC})$

$Q_{WIN} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{UNOCC})$

$Q_{ROOF} = \sum_{-5}^{60} ((T_{STRAT} - T_{OCC}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{OCC}) + ((T_{STRAT} - T_{UNOCC}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{UNOCC})$

Variable	Units	Description
$Q_{SAVINGS}$	Therms	Annual thermal savings
$\sum_{-5}^{60}$	-	Summation of all bins from -5°F to 60°F
μ	%	Diversity factor of de-stratification fans (25% - 50%)
Q_{TOTAL}	btu	Total heat loss
Q_{WALL}	btu	Heat loss through wall (above de-stratification fan)
Q_{ROOF}	btu	Heat loss through roof
Q_{WIN}	btu	Heat loss through windows (above de-stratification fan)
T_{BIN}	°F	Temperature of respective bin
T_{OCC}	°F	Existing temperature of space during occupied hours
T_{UNOCC}	°F	Existing temperature of space during unoccupied hours
T_{STRAT}	°F	Existing stratified temperature above de-stratification fan) during all heating hours
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Unoccupied Bin Hours in respective temperature bin
A_{WALL}	ft^2	Exposed wall area adove de-stratification fan
A_{ROOF}	ft^2	Exposed roof area adove de-stratification fan
A_{WINDOW}	ft^2	Exposed window area adove de-stratification fan
U_{WALL}	btu / ft^2 / °F	U-factor of wall
U_{ROOF}	btu / ft^2 / °F	U-factor of roof
U_{WIN}	btu / ft^2 / °F	U-factor of windows
W_{TOTAL}	kWh	Annual electrical consumption of fans
q	-	Quantity of fans
W_{FAN}	kW	Input kW of fan
t_{FAN}	Hrs	Annual run time of de-stratification fan (annual heating hours)

ASSUMPTIONS / DATA

* Inputs are in blue

Building	Location	Wall Length Perimeter (ft)	Wall Width Perimeter (ft)	Exposed Wall Height above Fan (ft)	Ceiling Height	Ceiling Type	Roof Area (ft^2)	Window Area (ft^2 - above Fan)	Roof U-Factor	Window U-Factor	Wall U-Factor	Temp. at Ceiling (oF)
Building 1/2/3/5/6	Bildg. 1 - Fitness Center	63	60	3.0	12.0	Ceiling Tiles	3,780	0	0.23	0.29	0.27	95.0
Building 1/2/3/5/6	Bldg. 1 - Gym	31	76	8.0	24-36-24	Truss	2,331	16	0.23	0.29	0.27	95.0
Building 1/2/3/5/6	Bldg. 1 -Gym	61	76	8.0	24-36-24	Truss	4,661	16	0.23	0.29	0.27	95.0

Morris County Vo-Tech
Exhibit D
ECM 1B Destratification Fans
De-stratifcation fans

Totals												

CALCULATIONS

	Building 1/2/3/5/6	**Building 1/2/3/5/6**	**Building 1/2/3/5/6**
Location #1	Bildg. 1 - Fitness Center	Bldg. 1 - Gym	Bldg. 1 -Gym
Wall Length	63	31	61
Wall Width	60	76	76
Wall Height Above Fan	3.0	8.0	8.0
Roof Area	3,780	2,331	4,661
Window Area	-	16	16
Wall Exposed Area	369	837	1,083
Roof U-Factor	0.23	0.23	0.23
Window U-Factor	0.29	0.29	0.29
Wall U-Factor	0.27	0.27	0.27
Fan Model	**Air Pear 15**	**Air Pear 45**	**Air Pear 25**
Total run hours	3,863	3,863	3,863
Fan Input watts	17	45	35
kwh consumed by fan	66	174	135
SF per Fan	800	1,500	1,200
Total Fans	5	3	6
Total Kwh Consumed	328	522	811
Existing Occupied Heating Setpoint	71.0	71.0	71.0
Existing Unoccup. Heating Setpoint	66.5	66.5	66.5
Diversity Factor	**85%**	**85%**	**85%**
Boiler Efficiency	78.0%	78.0%	78.0%
Additional Electric Usage	(328)	(522)	(811)
Calculated Fuel Savings Therms	1,209	955	1,707
Safety Factor Electric	**0%**	**0%**	**0%**
Safety Factor Thermal	**0%**	**0%**	**0%**
Additional Electric usage	(328)	(522)	(811)
Calculated Fuel Savings	1,209	955	1,707

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	$btu/ft^2/°F$	$btu/ft^2/°F$	$btu/ft^2/°F$	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	113	129	118	360	245	115	369	3,780	0	0.27	0.23	0.29	434,306	3,817,855	-	4,252,161
50 to 55	52.5	131	253	181	565	415	150	369	3,780	0	0.27	0.23	0.29	977,863	8,596,094	-	9,573,956
45 to 50	47.5	117	180	134	431	308	123	369	3,780	0	0.27	0.23	0.29	957,331	8,415,610	-	9,372,941
40 to 45	42.5	169	194	221	584	396	189	369	3,780	0	0.27	0.23	0.29	1,579,575	13,885,566	-	15,465,141
35 to 40	37.5	215	186	247	648	421	227	369	3,780	0	0.27	0.23	0.29	2,068,650	18,184,877	-	20,253,527
30 to 35	32.5	260	111	196	567	331	236	369	3,780	0	0.27	0.23	0.29	2,076,750	18,256,081	-	20,332,831
25 to 30	27.5	144	59	119	322	187	135	369	3,780	0	0.27	0.23	0.29	1,340,119	11,780,579	-	13,120,698
20 to 25	22.5	140	20	69	229	116	113	369	3,780	0	0.27	0.23	0.29	1,059,631	9,314,898	-	10,374,529
15 to 20	17.5	66	21	16	103	56	47	369	3,780	0	0.27	0.23	0.29	529,788	4,657,202	-	5,186,989
10 to 15	12.5	26	3	19	48	25	23	369	3,780	0	0.27	0.23	0.29	270,281	2,375,961	-	2,646,242
5 to 10	7.5	3	-	1	4	2	2	369	3,780	0	0.27	0.23	0.29	24,388	214,383	-	238,771
0 to 5	2.5	2	-	-	2	1	1	369	3,780	0	0.27	0.23	0.29	13,138	115,488	-	128,625
								369	3,780	0	0.27	0.23	0.29	-	-	-	-
								369	3,780	0	0.27	0.23	0.29	-	-	-	-
								369	3,780	0	0.27	0.23	0.29	-	-	-	-
Total		1,386	1,156	1,321	3,863	2,501	1,362							11,331,819	99,614,593	-	110,946,411

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	$btu/ft^2/°F$	$btu/ft^2/°F$	$btu/ft^2/°F$	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	113	129	118	360	245	115	837	2,331	16	0.27	0.23	0.29	985,526	2,354,007	20,152	3,359,685
50 to 55	52.5	131	253	181	565	415	150	837	2,331	16	0.27	0.23	0.29	2,218,962	5,300,166	45,373	7,564,501
45 to 50	47.5	117	180	134	431	308	123	837	2,331	16	0.27	0.23	0.29	2,172,372	5,188,884	44,420	7,405,676
40 to 45	42.5	169	194	221	584	396	189	837	2,331	16	0.27	0.23	0.29	3,584,365	8,561,541	73,292	12,219,199
35 to 40	37.5	215	186	247	648	421	227	837	2,331	16	0.27	0.23	0.29	4,694,172	11,212,404	95,985	16,002,561
30 to 35	32.5	260	111	196	567	331	236	837	2,331	16	0.27	0.23	0.29	4,712,553	11,256,307	96,361	16,065,221
25 to 30	27.5	144	59	119	322	187	135	837	2,331	16	0.27	0.23	0.29	3,040,992	7,263,651	62,182	10,366,825
20 to 25	22.5	140	20	69	229	116	113	837	2,331	16	0.27	0.23	0.29	2,404,511	5,743,366	49,167	8,197,044
15 to 20	17.5	66	21	16	103	56	47	837	2,331	16	0.27	0.23	0.29	1,202,192	2,871,530	24,582	4,098,304
10 to 15	12.5	26	3	19	48	25	23	837	2,331	16	0.27	0.23	0.29	613,321	1,464,966	12,541	2,090,828
5 to 10	7.5	3	-	1	4	2	2	837	2,331	16	0.27	0.23	0.29	55,340	132,184	1,132	188,656
0 to 5	2.5	2	-	-	2	1	1	837	2,331	16	0.27	0.23	0.29	29,812	71,207	610	101,628

Morris County Vo-Tech
Exhibit D
ECM 1B Destratification Fans
De-stratifcation fans

Total		1,386	1,156	1,321	3,863	2,501	1,362						25,714,118	61,420,214	525,796	87,660,129

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Exposed Wall area	Exposed Roof area	Window area	Wall U factor	Roof U factor	Window U factor	Wall Heat loss	Roof Heat Loss	Windows Heat Loss	Total Heat loss
HEATING								ft^2	ft^2	ft^2	$btu/ft^2/°F$	$btu/ft^2/°F$	$btu/ft^2/°F$	btu/Yr	btu/Yr	btu/Yr	btu/Yr
55 to 60	57.5	113	129	118	360	245	115	1,083	4,661	16	0.27	0.23	0.29	1,274,279	4,708,014	20,152	6,002,445
50 to 55	52.5	131	253	181	565	415	150	1,083	4,661	16	0.27	0.23	0.29	2,869,103	10,600,333	45,373	13,514,809
45 to 50	47.5	117	180	134	431	308	123	1,083	4,661	16	0.27	0.23	0.29	2,808,864	10,377,768	44,420	13,231,051
40 to 45	42.5	169	194	221	584	396	189	1,083	4,661	16	0.27	0.23	0.29	4,634,562	17,123,083	73,292	21,830,937
35 to 40	37.5	215	186	247	648	421	227	1,083	4,661	16	0.27	0.23	0.29	6,069,535	22,424,807	95,985	28,590,328
30 to 35	32.5	260	111	196	567	331	236	1,083	4,661	16	0.27	0.23	0.29	6,093,301	22,512,614	96,361	28,702,276
25 to 30	27.5	144	59	119	322	187	135	1,083	4,661	16	0.27	0.23	0.29	3,931,983	14,527,303	62,182	18,521,468
20 to 25	22.5	140	20	69	229	116	113	1,083	4,661	16	0.27	0.23	0.29	3,109,017	11,486,731	49,167	14,644,916
15 to 20	17.5	66	21	16	103	56	47	1,083	4,661	16	0.27	0.23	0.29	1,554,426	5,743,061	24,582	7,322,069
10 to 15	12.5	26	3	19	48	25	23	1,083	4,661	16	0.27	0.23	0.29	793,020	2,929,933	12,541	3,735,494
5 to 10	7.5	3	-	1	4	2	2	1,083	4,661	16	0.27	0.23	0.29	71,554	264,368	1,132	337,054
0 to 5	2.5	2	-	-	2	1	1	1,083	4,661	16	0.27	0.23	0.29	38,546	142,415	610	181,570
Total		1,386	1,156	1,321	3,863	2,501	1,362							33,248,191	122,840,429	525,796	156,614,416

Morris County Vo-Tech
Exhibit D
ECM 1C Vending Misers
Vending Misers

ECM DESCRIPTION

Install vending machines with vending misers, mounted on the respective vending machine.

DATA / ASSUMPTIONS

Cold Drink Run Hour Reduction	34%	
Snack Machine Run Hour Reduction	40%	
Typical Cold Drink Wattage	0.339	kW
Typical Snack Machine Wattage	0.041	kW

MEASUREMENT AND VERIFICATION

Option A -Pre M&V: Measurement of KW for 5% sample machines in each category Energy Savings scope with measured KW and compare to pre retrofit calculated savings.

COMMISSIONING

Confirm vending miser operation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Label	Type	Qty	Location
Building 1/2/3/5/6	VM-1	Cold Beverage	1	Cafeteria
Building 1/2/3/5/6	VM-2	Snack	1	Cafeteria
Building 1/2/3/5/6	VM-3	Snack	1	Gym

Morris County Vo-Tech
Exhibit D
ECM 1C Vending Misers
Vending Misers

Building 4	VM-4	Snack	1	Roof Access-Storage
Building 4	VM-5	Cold Beverage	1	Roof Access-Storage
Totals	-	-	**5**	-

CALCULATION

	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 4	Building 4
Label	VM-1	VM-2	VM-3	VM-4	VM-5
Type	Cold Beverage	Snack	Snack	Snack	Cold Beverage
Location	Cafeteria	Cafeteria	Gym	Roof Access-Storage	Roof Access-Storage
Quantity	1	1	1	1	1
Run Hours	**8,760**	**8,760**	**8,760**	**8,760**	**8,760**
Existing kWh Consumption	2,970	359	359	359	2,970
Proposed kWh Consumption	1,960	215	215	215	1,960
Safety Factor	0%	0%	0%	0%	0%
kWh Savings	1,010	144	144	144	1,010

Morris County Vo-Tech
Exhibit D
ECM 1D Lighting Controls
Lighting Controls and Heating Penalty

ECM DESCRIPTION

Retrofit existing lighting fixtures with new energy efficient lighting fixtures, install motion sensors and implement daylight harvesting in selected areas

DATA / ASSUMPTIONS

* Heating Season	20	Weeks
** Fraction of heat to be made-up	40.0%	
Heating Hours (Weather Data)	3,863	Hours

** Fraction of the Year Representing the Cooling Season Liberal estimate of the heating season, as there are times during the year when the building is neither heated nor cooled.
*** Fraction of the Lighting Reduction that Has to Be Made Up by Heating a portion of the lighting heat is released at night plus interior zones will have limited heating loads

MEASUREMENT AND VERIFICATION

Option A - The Engineering Calculations are based on 5% of the retrofitted lighting fixtures direct kW measurements and operating hours. The kW Measurements are taken for existing lighting fixtures before removal and for new installed lighting fixtures. Lighting operating hours are agreed by client basis from the audit, logging data, and operating personal input. The occupancy sensors savings are calculated as % of operating hours based on logging data and historical statistical data

COMMISSIONING

Confirm lighting operation and occupancy sensors functions

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Relatively high safety factor is used for this ECM because of direct measurements are proven over the time and savings are stipulated

CALCULATIONS

Detailed energy savings calculations are in the line-by-line calculation sheet

*Inputs are blue

Building	Lighting Controls Savings (kWh)
Building 1/2/3/5/6	3,949
Building 4	2,433

Morris County Vo-Tech
Exhibit D
ECM 1D Lighting Controls
Lighting Controls and Heating Penalty

Totals	**6,382**

CALCULATIONS

	Building 1/2/3/5/6	Building 4
Lighting Safety Factor	0%	0%
Lighting Savings	3,949	2,433
Heating Season	20	20
** % of Heating Season	38%	38%
***Fraction of Heat to be Made-up	40%	40%
****Annual Equivalent of Lighting kWh Saved in Therms	135	83
Current Boiler Efficiency	78.0%	93.0%
Heating Penalty	(27)	(14)

Morris County Vo-Tech
Exhibit D
#N/A
Boiler Replacement Calculation

ECM DESCRIPTION

Replace boilers in respective buildings with new high efficiency condensing boilers

DATA / ASSUMPTIONS

Typical Condensing Boiler Seasonal Efficiency = **91.5%**
Heating Hours 3,863 Hours

* Utility baseline reduced by 10.5% to account for domestic hot water, science labs, and kitchen usage
* An adjusted baseline is used for the boiler baseline usage as to not double-dip on savings

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the boiler control system, safety and operation. Verify air/fuel ratio is consistent through firing range. Provide training of the boiler operators

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) = **0%**

A safety factor of 0 is used due to minimal variables and the proven results of this measure

FORMULAE

$Q_{savings} = ((\eta_{NEW} - \eta_{OLD}) / \eta OLD) - Fuel_{ADJ}$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
η_{NEW}	%	Efficiency of New Boiler
η_{OLD}	%	Efficiency of Old Boiler
$Fuel_{ADJ}$	Therms	Adjusted Boiler Fuel Usage

*Inputs are blue

Building	Label	Boilers to be Replaced
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Totals		-

CALCULATIONS

	Total	
Label		
No. of Units to be Replaced	**0**	
Fuel Switch		
Existing Fuel		
Proposed Fuel		
Current Boiler Efficiency		%
Proposed Boiler Efficiency		%
Improvement in Boiler Efficiency		%
Annual Boiler Fuel Use		Therms/Yr
Adjusted Boiler Usage		Therms/Yr
Percentage of Building Load		%
Safety Factor		%
Thermal Savings	-	Therms / Yr
Proposed Boiler Usage		Therms / Yr
Natural Gas Savings	-	Therms / Yr
Fuel Oil #2 Savings	-	Therms / Yr
Fuel Oil #4 Savings	-	Therms / Yr
Fuel Oil #6 Savings	-	Therms / Yr
Propane Savings	-	Therms / Yr

Notes:
Replacing the existing boiler with a new, high efficiency unit will reduce operating costs at this location.
Improving the air/fuel ratio will increase overall boiler combustion efficiency.
Note that the boiler efficiency discussed here is the overall boiler thermal efficiency, not just its combustion efficiency. The value of this number will be much lower than for combustion efficiency alone as it includes losses from radiation, blowdown, and other related losses. The value for annual boiler fuel has been adjusted for the effect of other ECMs.
New Non -Condensing Boilers will be Equiped with Control Links

Morris County Vo-Tech
Exhibit D
ECM 2A DHW Boiler Replacements
Domestic Hot Water Upgrades

ECM DESCRIPTION

Replacement of Domestic Hot Water Heaters with high efficiency condensing Domestic Hot Water Heaters

DATA / ASSUMPTIONS

*Isolating a storage tank improves the DHW system efficiency by:	**3.0%**
Current DHW Heater Efficiency	**Varies**

MEASUREMENT AND VERIFICATION

Option C - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the boiler control system, safety and operation. Verify air/fuel ratio is consistent through firing range. Provide training of the boiler operators

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	**0.0%**
Safety Factor (Thermal) =	**0.0%**

No Safety Factor is used because of a minimal of variables

DHW REPLACEMENT CALCULATION

$Q_{savings} = ((\eta_{NEW} - \eta_{OLD}) / \eta OLD) \cdot Fuel_{DHW}$

Variable	Units	Description
$Q_{Savings}$	Therms	Thermal Savings
η_{NEW}	**%**	Efficiency of Existing DHW Heater
η_{OLD}	**%**	Efficiency of Proposed DHW Heater
$Fuel_{DHW}$	Therms	Annual DHW Fuel Consumption

*Inputs are blue

Building	Label	DHW Quantity
Building 1/2/3/5/6	DHW-1	1

Morris County Vo-Tech
Exhibit D
ECM 2A DHW Boiler Replacements
Domestic Hot Water Upgrades

-	-	-
Totals		**1**

A. DOMESTIC HOT WATER HEATER REPLACEMENT

	Building 1/2/3/5/6
Label	DHW-1
Quantity	1
Fuel Switch	N
Existing Fuel	Natural Gas
Proposed Fuel	Natural Gas
Current DHW System Efficiency	80.0%
Proposed DHW System Efficiency	95.0%
Improvement DHW System Efficiency	15%
Annual DHW Heater Baseline	4,434
Percentage of DHW Building Load	1
Safety Factor	**0%**
Thermal Savings	831
Electric Savings	-
Natural Gas Savings	831
Fuel Oil #2 Savings	-
Fuel Oil #4 Savings	-
Fuel Oil #6 Savings	-
Propane Savings	-

B. STORAGE TANK ISOLATION

Storage Tank Isolation
Current DHW System Efficiency
Improvement in System Efficiency
New System Efficiency
Safety Factor
Thermal Savings
Electric Savings
Natural Gas Savings
Fuel Oil #2 Savings
Fuel Oil #4 Savings
Fuel Oil #6 Savings
Propane Savings

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

ECM DESCRIPTION

Replace existing Rooftop Units with high efficiency units

DATA / ASSUMPTIONS

RTU Supply Air Temperature is assumed at, unless stated otherwise 85 °F
Full Load is estimated at 11°F for heating and 92.5°F for cooling unless stated otherwise

MEASUREMENT AND VERIFICATION

Option A (Electric) - Direct kW and savings measurements before and after installation conducted. A report is generated showing the reduction in kW
Option C (Fuel) - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify all functions of the rooftop system, safety and operation.

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) = 0%

A safety factor of 0 is used due to minimal variables and the proven results of this measure

FORMULAE

$W_{SAVINGS} = W_C - W_C$

$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$
$W_C = (W_{C\text{-}OCC} + W_{C\text{-}UNOCC})$

$W_{C\text{-}OCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$W_{C\text{-}OCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{OCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{OCC} \cdot \eta$
$W_{C\text{-}UNOCC} = \sum_{60}^{105} C \cdot (T_{BIN} - T_{UNOCC}) / (T_{BIN} - T_{DESIGN}) \cdot t_{UNOCC} \cdot \eta$

$Q_{SAVINGS} = \sum_{-5}^{60} Q_{INPUT} - Q_{INPUT}$

$Q_{INPUT} = \sum_{-5}^{60} (t_{OCC} \cdot Q_{LOAD} \cdot L_{\%}) / \eta_{RTU}$
$Q_{INPUT} = \sum_{-5}^{60} (t_{OCC} \cdot Q_{LOAD} \cdot L_{\%}) / \eta_{RTU}$

$Q_{LOAD} = \sum_{-5}^{60} 1.08 \cdot CFM_{SUPPLY} \cdot (T_{SUPPLY} - T_{MIXED})$

$T_{RISE} = \sum_{-5}^{60} T_{SUPPLY} - T_{MIXED}$

$T_{MIXED} = \sum_{-5}^{60} ((CFM_{RETURN} \cdot T_{RETURN}) + (CFM_{OA} \cdot T_{BIN})) / (CFM_{RETURN} + CFM_{OA})$

Variable	Units	Description
$W_{SAVINGS}$	kWh	Electrical Savings
W_C	kWh	Existing RTU Consumption
W_C	kWh	Proposed RTU Consumption
$\eta_{\%}$	%	Efficiency gain due to RTU optimization
$\sum_{60}^{105}$	-	Summation of all bins from 60°F to 105°F
C	Ton	Tonnage of RTU
η	-	Existing efficiency of RTU (EER)
η	-	Proposed efficiency of RTU (EER)
T_{DESIGN}	°F	Design Temperature of RTU (Usually 97.5°F)
T_{BIN}	°F	Bin Weather Temperature
T_{OCC}	°F	Temperature of building during occupied hours
T_{UNOCC}	°F	Temperature of building during unoccupied hours

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

t_{OCC}	Hrs	Existing occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Existing unoccupied Bin Hours in respective temperature bin
$Q_{SAVINGS}$	Therms	Thermal Savings
$\sum_{-5}^{60}$	-	Summation of all bins from -5°F to 60°F
T_{BIN}	°F	Temperature of respective bin
Q_{INPUT}	Therms	Existing Input heat provided by RTUs at respective bin temperature
Q_{INPUT}	Therms	Proposed Input heat provided by RTUs at respective bin temperature
Q_{LOAD}	Therms	Heat load on the unit vent
$L_{\%}$	%	Load % at respective bin
T_{RISE}	°F	Temperature rise across the coil (100% Design at 10°F)
T_{MIXED}	°F	Mixed air temperature
T_{SUPPLY}	Hrs	Temperature of supply air
T_{RETURN}	Hrs	Temperature of return air
CFM_{SUPPLY}	CFM	Total supply CFM of unit vent
CFM_{OA}	CFM	Total outside air CFM of unit vent
CFM_{RETURN}	CFM	Total return air CFM of unit vent
q	-	Quantity of replaced/refurbished RTUs
η_{REFURB}	**%**	Efficiency improvement of refurbished unit vent
$\eta_{REPLACE}$	**%**	Efficiency improvement of replaced unit vent
t_{OCC}	Hrs	Occupied Bin Hours in respective temperature bin

* Inputs are in blue
*Checks against baseline are in purple

Building	Label	Thermal Fuel	Area Serving
Building 1/2/3/5/6	RT-1-20	Natural Gas	Fitness Center
Building 1/2/3/5/6	RT-1-21	Natural Gas	Locker Rooms
Building 1/2/3/5/6	RT-1-22	Natural Gas	Faculty Dining
Building 1/2/3/5/6	RT-1-23	Natural Gas	Dining Hall
Building 4	RT-4.4	Natural Gas	Biology Lab 412
Building 4	RT-4.5	Natural Gas	Chemistry Lab 417

Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 4	Building 4	-	-	-	-	-	-	-	-
RT-1-20	RT-1-21	RT-1-22	RT-1-23	RT-4.4	RT-4.5	-	-	-	-	-	-	-	-
Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	-	-	-	-	-	-	-	-
Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	-	-	-	-	-	-	-	-
Fitness Center	Locker Rooms	Faculty Dining	Dining Hall	Biology Lab 412	Chemistry Lab 417	-	-	-	-	-	-	-	-
13.1	11.5	17	13.1	11.5	13.1	-	-	-	-	-	-	-	-

CALCULATIONS

	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 4	Building 4
Label	RT-1-20	RT-1-21	RT-1-22	RT-1-23	RT-4.4	RT-4.5
Fuel Switch	N	N	N	N	N	N
Existing Thermal Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Proposed Thermal Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Area Serving	Fitness Center	Locker Rooms	Faculty Dining	Dining Hall	Biology Lab 412	Chemistry Lab 417
Quantity	1	1	1	1	1	1
RTU Tonnage	12.5	15.0	4.0	30.0	15.0	12.5
RTU Supply Air CFM	5,000	3,100	1,600	12,000	6,000	5,000
RTU Fresh Air CFM	750	465	240	1,800	900	750
RTU Return Air CFM	4,250	2,635	1,360	10,200	5,100	4,250
Current Thermal Efficiency	78%	78%	78%	78%	78%	78%
Proposed Thermal Efficiency	80%	80%	80%	80%	80%	80%
Current EER	11.3	9.0	9.5	9.0	9.0	9.0
Proposed EER	13.1	11.5	17.0	13.1	11.5	13.1
Existing Occupied Heating Setpoint	71.0	71.0	71.0	71.0	71.0	71.0
Existing Unoccupied Heating Setpoint	66.5	66.5	66.5	66.5	65.0	65.0
Existing Occupied Cooling Setpoint	73.0	73.0	73.0	73.0	73.0	73.0
Existing Unoccupied Cooling Setpoint	77.5	77.5	77.5	77.5	79.0	79.0
Supply Air Temperature	85.0	85.0	85.0	85.0	85.0	85.0
Current RTU kWh Consumption	7,847	14,422	3,643	28,843	13,335	11,113
Current RTU Thermal Consumption	3,166	1,963	1,013	7,599	4,055	3,379
Percent of Electric Baseline Consumption	**0.7%**	**1.2%**	**0.3%**	**2.5%**	**2.2%**	**1.9%**
Percent of Thermal Baseline Consumption	**3.8%**	**2.3%**	**1.2%**	**9.0%**	**9.4%**	**7.8%**

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

Proposed RTU kWh Consumption	6,769	11,286	2,036	19,816	10,436	7,635
Proposed RTU Thermal Consumption	3,087	1,914	988	7,409	3,954	3,295
Safety Factor	0%	0%	0%	0%	0%	0%
Electrical Savings	1,078	3,135	1,607	9,027	2,899	3,478
Natural Gas Savings	79	49	25	190	101	84

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption	Proposed Condensing Unit Consumption	Savings
COOLING												kWh	kWh	kWh
100 to 105	102.5	-	-	-	-	-	-	12.5	12.5	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	12.5	12.5	63	-	66	57	9
90 to 95	92.5	-	34	2	36	35	1	12.5	12.5	441	9	478	412	66
85 to 90	87.5	1	100	27	128	117	11	8.5	6.3	993	67	1,126	971	155
80 to 85	82.5	17	328	92	437	392	45	6.5	3.1	2,528	141	2,835	2,445	389
75 to 80	77.5	106	270	200	576	435	141	4.4	-	1,928	-	2,048	1,766	281
70 to 75	72.5	226	185	248	659	425	234	2.4	-	1,028	-	1,091	941	150
65 to 70	67.5	245	207	283	735	476	259	0.4	-	192	-	204	176	28
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	47.2	34.4	7,172	218	7,847	6,769	1,078

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	65.2	19.9	107,190	72.6%	19,069,753
50 to 55	52.5	131	253	181	565	415	150	64.4	20.6	111,240	75.3%	34,792,089
45 to 50	47.5	117	180	134	431	308	123	63.7	21.4	115,290	78.1%	27,685,592
40 to 45	42.5	169	194	221	584	396	189	62.9	22.1	119,340	80.8%	38,138,839
35 to 40	37.5	215	186	247	648	421	227	62.2	22.9	123,390	83.5%	43,400,120
30 to 35	32.5	260	111	196	567	331	236	61.4	23.6	127,440	86.3%	36,398,914
25 to 30	27.5	144	59	119	322	187	135	60.7	24.4	131,490	89.0%	21,935,423
20 to 25	22.5	140	20	69	229	116	113	59.9	25.1	135,540	91.8%	14,382,541
15 to 20	17.5	66	21	16	103	56	47	59.2	25.9	139,590	94.5%	7,355,334
10 to 15	12.5	26	3	19	48	25	23	58.4	26.6	143,640	97.3%	3,440,139
5 to 10	7.5	3	-	1	4	2	2	57.7	27.4	147,690	100.0%	258,458
0 to 5	2.5	2	-	-	2	1	1	56.9	28.1	151,740	100.0%	113,805
-5 to 0	-2.5	-	-	-	-	-	-	56.2	28.9	155,790	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	55.4	29.6	159,840	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	54.7	30.4	163,890	100.0%	-
Total		1,386	1,156	1,321	3,863	2,256	1,362					246,971,006

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	-	-	-	-	-	15.0	15.0	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	15.0	15.0	75	-	100	78	22
90 to 95	92.5	-	34	2	36	35	1	15.0	15.0	529	11	720	563	157
85 to 90	87.5	1	100	27	128	117	11	10.4	10.4	1,218	112	1,772	1,387	385
80 to 85	82.5	17	328	92	437	392	45	8.1	8.1	3,165	364	4,706	3,683	1,023
75 to 80	77.5	106	270	200	576	435	141	5.8	5.8	2,508	815	4,431	3,468	963
70 to 75	72.5	226	185	248	659	425	234	3.5	-	1,470	-	1,960	1,534	426
65 to 70	67.5	245	207	283	735	476	259	1.2	-	549	-	732	573	159
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	58.8	54.2	9,514	1,302	14,422	11,286	3,135

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	65.2	19.9	66,458	72.6%	11,823,247
50 to 55	52.5	131	253	181	565	415	150	64.4	20.6	68,969	75.3%	21,571,095
45 to 50	47.5	117	180	134	431	308	123	63.7	21.4	71,480	78.1%	17,165,067
40 to 45	42.5	169	194	221	584	396	189	62.9	22.1	73,991	80.8%	23,646,080
35 to 40	37.5	215	186	247	648	421	227	62.2	22.9	76,502	83.5%	26,908,075

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

30 to 35	32.5	260	111	196	567	331	236	61.4	23.6	79,013	86.3%	22,567,327
25 to 30	27.5	144	59	119	322	187	135	60.7	24.4	81,524	89.0%	13,599,962
20 to 25	22.5	140	20	69	229	116	113	59.9	25.1	84,035	91.8%	8,917,175
15 to 20	17.5	66	21	16	103	56	47	59.2	25.9	86,546	94.5%	4,560,307
10 to 15	12.5	26	3	19	48	25	23	58.4	26.6	89,057	97.3%	2,132,886
5 to 10	7.5	3	-	1	4	2	2	57.7	27.4	91,568	100.0%	160,244
0 to 5	2.5	2	-	-	2	1	1	56.9	28.1	94,079	100.0%	70,559
-5 to 0	-2.5	-	-	-	-	-	-	56.2	28.9	96,590	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	55.4	29.6	99,101	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	54.7	30.4	101,612	100.0%	-
Total		1,386	1,156	1,321	3,863	2,501	1,362					153,122,024

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	-	-	-	-	-	4.0	4.0	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	4.0	4.0	20	-	25	14	11
90 to 95	92.5	-	34	2	36	35	1	4.0	4.0	141	3	182	102	80
85 to 90	87.5	1	100	27	128	117	11	2.8	2.8	325	30	448	250	198
80 to 85	82.5	17	328	92	437	392	45	2.2	2.2	844	97	1,189	664	525
75 to 80	77.5	106	270	200	576	435	141	1.5	1.5	669	217	1,119	626	494
70 to 75	72.5	226	185	248	659	425	234	0.9	-	392	-	495	277	218
65 to 70	67.5	245	207	283	735	476	259	0.3	-	146	-	185	103	82
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	15.7	14.5	2,537	347	3,643	2,036	1,607

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	65.2	19.9	34,301	72.6%	6,102,321
50 to 55	52.5	131	253	181	565	415	150	64.4	20.6	35,597	75.3%	11,133,469
45 to 50	47.5	117	180	134	431	308	123	63.7	21.4	36,893	78.1%	8,859,389
40 to 45	42.5	169	194	221	584	396	189	62.9	22.1	38,189	80.8%	12,204,428
35 to 40	37.5	215	186	247	648	421	227	62.2	22.9	39,485	83.5%	13,888,039
30 to 35	32.5	260	111	196	567	331	236	61.4	23.6	40,781	86.3%	11,647,653
25 to 30	27.5	144	59	119	322	187	135	60.7	24.4	42,077	89.0%	7,019,335
20 to 25	22.5	140	20	69	229	116	113	59.9	25.1	43,373	91.8%	4,602,413
15 to 20	17.5	66	21	16	103	56	47	59.2	25.9	44,669	94.5%	2,353,707
10 to 15	12.5	26	3	19	48	25	23	58.4	26.6	45,965	97.3%	1,100,844
5 to 10	7.5	3	-	1	4	2	2	57.7	27.4	47,261	100.0%	82,706
0 to 5	2.5	2	-	-	2	1	1	56.9	28.1	48,557	100.0%	36,418
-5 to 0	-2.5	-	-	-	-	-	-	56.2	28.9	49,853	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	55.4	29.6	51,149	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	54.7	30.4	52,445	100.0%	-
Total		1,386	1,156	1,321	3,863	2,501	1,362					79,030,722

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	-	-	-	-	-	30.0	30.0	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	30.0	30.0	150	-	200	137	63
90 to 95	92.5	-	34	2	36	35	1	30.0	30.0	1,058	23	1,440	989	451
85 to 90	87.5	1	100	27	128	117	11	20.8	20.8	2,435	223	3,545	2,435	1,109
80 to 85	82.5	17	328	92	437	392	45	16.2	16.2	6,330	729	9,412	6,466	2,946
75 to 80	77.5	106	270	200	576	435	141	11.5	11.5	5,016	1,630	8,862	6,088	2,773
70 to 75	72.5	226	185	248	659	425	234	6.9	-	2,941	-	3,921	2,694	1,227
65 to 70	67.5	245	207	283	735	476	259	2.3	-	1,098	-	1,464	1,006	458
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	117.7	108.5	19,028	2,605	28,843	19,816	9,027

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	65.2	19.9	257,256	72.6%	45,767,406
50 to 55	52.5	131	253	181	565	415	150	64.4	20.6	266,976	75.3%	83,501,015
45 to 50	47.5	117	180	134	431	308	123	63.7	21.4	276,696	78.1%	66,445,421
40 to 45	42.5	169	194	221	584	396	189	62.9	22.1	286,416	80.8%	91,533,213
35 to 40	37.5	215	186	247	648	421	227	62.2	22.9	296,136	83.5%	104,160,289
30 to 35	32.5	260	111	196	567	331	236	61.4	23.6	305,856	86.3%	87,357,394
25 to 30	27.5	144	59	119	322	187	135	60.7	24.4	315,576	89.0%	52,645,014
20 to 25	22.5	140	20	69	229	116	113	59.9	25.1	325,296	91.8%	34,518,098
15 to 20	17.5	66	21	16	103	56	47	59.2	25.9	335,016	94.5%	17,652,801
10 to 15	12.5	26	3	19	48	25	23	58.4	26.6	344,736	97.3%	8,256,333
5 to 10	7.5	3	-	1	4	2	2	57.7	27.4	354,456	100.0%	620,298
0 to 5	2.5	2	-	-	2	1	1	56.9	28.1	364,176	100.0%	273,132
-5 to 0	-2.5	-	-	-	-	-	-	56.2	28.9	373,896	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	55.4	29.6	383,616	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	54.7	30.4	393,336	100.0%	-
Total		1,386	1,156	1,321	3,863	2,501	1,362					592,730,414

BUILDING 4

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	-	-	-	-	-	15.0	15.0	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	15.0	15.0	75	-	100	78	22
90 to 95	92.5	-	34	2	36	35	1	15.0	15.0	529	11	720	563	157
85 to 90	87.5	1	100	27	128	117	11	10.4	10.4	1,218	112	1,772	1,387	385
80 to 85	82.5	17	328	92	437	392	45	8.1	8.1	3,165	364	4,706	3,683	1,023
75 to 80	77.5	106	270	200	576	435	141	5.8	-	2,508	-	3,344	2,617	727
70 to 75	72.5	226	185	248	659	425	234	3.5	-	1,470	-	1,960	1,534	426
65 to 70	67.5	245	207	283	735	476	259	1.2	-	549	-	732	573	159
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	58.8	48.5	9,514	487	13,335	10,436	2,899

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	63.9	21.1	136,890	73.8%	24,763,416
50 to 55	52.5	131	253	181	565	415	150	63.1	21.9	141,750	76.4%	44,981,639
45 to 50	47.5	117	180	134	431	308	123	62.4	22.6	146,610	79.0%	35,647,437
40 to 45	42.5	169	194	221	584	396	189	61.6	23.4	151,470	81.7%	48,919,188
35 to 40	37.5	215	186	247	648	421	227	60.9	24.1	156,330	84.3%	55,468,478
30 to 35	32.5	260	111	196	567	331	236	60.1	24.9	161,190	86.9%	46,364,297
25 to 30	27.5	144	59	119	322	187	135	59.4	25.6	166,050	89.5%	27,852,803
20 to 25	22.5	140	20	69	229	116	113	58.6	26.4	170,910	92.1%	18,208,166
15 to 20	17.5	66	21	16	103	56	47	57.9	27.1	175,770	94.8%	9,285,683
10 to 15	12.5	26	3	19	48	25	23	57.1	27.9	180,630	97.4%	4,331,472
5 to 10	7.5	3	-	1	4	2	2	56.4	28.6	185,490	100.0%	324,608
0 to 5	2.5	2	-	-	2	1	1	55.6	29.4	190,350	100.0%	142,763
-5 to 0	-2.5	-	-	-	-	-	-	54.9	30.1	195,210	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	54.1	30.9	200,070	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	53.4	31.6	204,930	100.0%	-
Total		1,386	1,156	1,321	3,863	2,501	1,362					316,289,949

BUILDING 4

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occup.Bin Hours	Unocc. Bin Hours	Occupied Tons	Unoccupied Tons	Occupied Ton-Hrs	Unoccupied Ton-Hrs	Current Condensing Unit Consumption (kWh)	Proposed Condensing Unit Consumption (kWh)	Savings (kWh)
COOLING														
100 to 105	102.5	-	-	-	-	-	-	12.5	12.5	-	-	-	-	-
95 to 100	97.5	-	5	-	5	5	-	12.5	12.5	63	-	83	57	26
90 to 95	92.5	-	34	2	36	35	1	12.5	12.5	441	9	600	412	188
85 to 90	87.5	1	100	27	128	117	11	8.7	8.7	1,015	93	1,477	1,015	462
80 to 85	82.5	17	328	92	437	392	45	6.7	6.7	2,638	304	3,922	2,694	1,227
75 to 80	77.5	106	270	200	576	435	141	4.8	-	2,090	-	2,787	1,915	872
70 to 75	72.5	226	185	248	659	425	234	2.9	-	1,225	-	1,634	1,122	511
65 to 70	67.5	245	207	283	735	476	259	1.0	-	457	-	610	419	191

Morris County Vo-Tech
Exhibit D
ECM 2B RTU Replacements
Rooftop Unit Replacement

60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-
Total		943	1,283	1,092	3,318	2,319	999	49.0	40.4	7,928	406	11,113	7,635	3,478

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Mixed Air Temp	Temp rise across coil	Heat Load on the unit	Load % at bin O/A temp (Note 1)	Heat provided by unit
HEATING								°F	°F	btu/hr	%	Btu/Yr
55 to 60	57.5	113	129	118	360	245	115	63.9	21.1	114,075	73.8%	20,636,180
50 to 55	52.5	131	253	181	565	415	150	63.1	21.9	118,125	76.4%	37,484,699
45 to 50	47.5	117	180	134	431	308	123	62.4	22.6	122,175	79.0%	29,706,198
40 to 45	42.5	169	194	221	584	396	189	61.6	23.4	126,225	81.7%	40,765,990
35 to 40	37.5	215	186	247	648	421	227	60.9	24.1	130,275	84.3%	46,223,732
30 to 35	32.5	260	111	196	567	331	236	60.1	24.9	134,325	86.9%	38,636,915
25 to 30	27.5	144	59	119	322	187	135	59.4	25.6	138,375	89.5%	23,210,669
20 to 25	22.5	140	20	69	229	116	113	58.6	26.4	142,425	92.1%	15,173,471
15 to 20	17.5	66	21	16	103	56	47	57.9	27.1	146,475	94.8%	7,738,070
10 to 15	12.5	26	3	19	48	25	23	57.1	27.9	150,525	97.4%	3,609,560
5 to 10	7.5	3	-	1	4	2	2	56.4	28.6	154,575	100.0%	270,506
0 to 5	2.5	2	-	-	2	1	1	55.6	29.4	158,625	100.0%	118,969
-5 to 0	-2.5	-	-	-	-	-	-	54.9	30.1	162,675	100.0%	-
-10 to -5	-7.5	-	-	-	-	-	-	54.1	30.9	166,725	100.0%	-
-15 to -10	-12.5	-	-	-	-	-	-	53.4	31.6	170,775	100.0%	-
Total		1,386	1,156	1,321	3,863	2,501	1,362					263,574,958

Morris County Vo-Tech
Exhibit D
ECM 2C Kitchen Equipment Replacements
Kitchen Equipment Upgrades

ECM DESCRIPTION

Convert Kitchen Appliances from Electric to Gas

DATA / ASSUMPTIONS

Savings achieved by converting electric kitchen appliances to gas appliances

Demand Load Factor	50%
Consumption Load Factor	50%
Relative Appliance Efficiency	90%

MEASUREMENT AND VERIFICATION

OPTION A - Stipulated Savings - Electric
OPTION C - Utility Bill Analysis. - Thermal

COMMISSIONING

Ensure all equipment is installed and working properly

RECOVERY/SAFETY FACTOR

Safety Factor (Electrical) =	0%
Safety Factor (Thermal) =	0%

FORMULAE

UsageFUEL = (EkWh · 3,412 / 100,000) / APP
EkWh = EkW · LFCons
EkW = APPkW · LFDemand

Variable	Units	Description
EkWh	kWh	Electric consumption savings
EkW	kW	Electric demand savings
UsageFUEL	Therms	Proposed fuel consumption
LFCons	%	Consumption load factor
LFDemand	%	Demand load factor
APP	%	Appliance thermal efficiency
APPkW	kW	Electrical appliance kW load
Op. Hrs	Hrs	Operating hours

*Inputs are blue

Building	Label	kW	MBH	Qty	Type
Building 1/2/3/5/6	K-1	25.0	100.0	1.0	Convection Oven
Building 1/2/3/5/6	K-4	15.0	105.0	1.0	Dishwasher Booster Heater
Totals		**40.0**			

Building 1/2/3/5/6	Building 1/2/3/5/6	-	-	-	-
K-1	K-4	-	-	-	-
25	15	-	-	-	-
100	105	-	-	-	-
1	1	-	-	-	-
Convection Oven	Dishwasher Booster H	-	-	-	-

CALCULATIONS

	Building 1/2/3/5/6	Building 1/2/3/5/6
Appliance Label	K-1	K-4
Qty	1	1
Total kW	25.000	15.000
Demand Load Factor	0.500	0.500
Consumption Load Factor	0.5	0.5
Operating Months Per Year	**9**	**9**
Operating Days Per Year	**160**	**160**
Operating Hours Per Day	**5**	**5**
Annual Operating Hours	800	800
Monthly Demand Savings (kW)	12.5	7.5
Annual Demand Savings (kW)	112.5	67.5
Consumption Savings (kWh)	5,000.0	3,000.0
Relative Appliance Efficiency	0.90	0.90
Safety Factor - Electric	0	0
Safety Factor - Thermal	0	0
Therms	**(189.56)**	**(113.73)**
kWh Savings	5,000.0	3,000.0
kW Savings	13	8

Morris County Vo-Tech
Exhibit D
ECM 2D Kitchen Hood Controls
Kitchen Hood Replacement

ECM DESCRIPTION

Kitchen hoods in the district's kitchens are ventilated by exhaust fans. Fans are running most of the time at full speed when kitchen is in operation even if there are no activities under the hoods. e new ventilaton control systems will control exhaust fans based on hood exhaust temperatures. The exhaust fan will be equipped with VFDs will control air flows. If the exhaust fan is combined with a make up air unit, then variable air flow will be controlled on both exhaust and make up air fans.

DATA / ASSUMPTIONS

Existing equipment schedule was given by personnel operating the kitchen equipment and with interviews with facility staff

MEASUREMENT AND VERIFICATION

Option A (Both Electric and Fuel) - Measure kW, logging fan operation and calculate energy savings, both electric and fuel, from collected data with fan and make up air info from manufacturer.

COMMISSIONING

Test exhaust fans and make up air units that they operate per design intent, which include simulation of the exhaust temperature driving fan motor speeds. Verify all safety interlocks.

RECOVERY/SAFETY FACTOR

Recovery/Safety Factor (Electric) =	0%
Recovery/Safety Factor (Thermal) =	0%

Savings calculations are based on weather bin data, make up air flow and operating schedules. A more conservative is used for heating losses due to the uncertainty of the basic operating information in terms of the volume of air being exhausted and other operating perimeters. The heating fuel saving calculations are based upon information provided by the equipment vendor. The exhaust fan electric savings are based on existing fan schedules and proposed fan schedules. Recovery factor of the electric savings is less conservative due to knowledge of technical data and agreed operating schedule.

FORMULAE

$W_{SAVINGS} = (W_{FAN} - W_{FAN})$

$Q_{SAVINGS} = (Q_{HOOD} - Q_{HOOD}) / n_{Boiler}$

$W_{FAN} = \sum_{0\%}^{100\%} HP \cdot Lf \cdot .746 \cdot t_{HOOD}$

$W_{FAN} = \sum_{0\%}^{100\%} (HP \cdot Lf \cdot .746) \cdot RPM_{\%}^{3} \cdot t_{HOOD}$

$Q_{HOOD} = (1.08 \cdot V_{EX} \cdot HD_{OCC} \cdot (t_{HOOD} / t_{HOOD} + t_{OCC})) / (n_{sys} \cdot 100{,}000)$

Morris County Vo-Tech
Exhibit D
ECM 2D Kitchen Hood Controls
Kitchen Hood Replacement

$Q_{HOOD} = (1.08 \cdot V_{EX} \cdot HD_{OCC} \cdot (t_{HOOD} / t_{HOOD} + t_{OCC})) / (n_{sys} \cdot 100{,}000)$

$V_{EX} = V_{EX} \cdot RPM_W$

Variable	Units	Description
$W_{savings}$	kWh	kWh Savings
$Q_{savings}$	Therms	Thermal Savings
W_{FAN}	kWh	Existing Annual Fan Electricial Consumption
W_{FAN}	kWh	Proposed Annual Fan Electricial Consumption
HP	HP	Horsepower of Exhaust Fan
$\sum_{0\%}^{100\%}$	-	Summation of run times
$RPM_{\%}$	RPM	Percentage of RPM compared to the motors full speed (0% - 100%)
RPM_W	RPM	Weighted RPM of Exhaust Fan
Lf	-	Load Factor of motor
n_{sys}	-	Existing system efficiency
V_{EX}	CFM	Current Exhaust Volume
V_{EX}	CFM	Proposed Exhaust Volume
Q_{HOOD}	Therms	Existing Heat Load of Kitchen Hood
Q_{HOOD}	Therms	Proposed Heat Load of Kitchen Hood
T_{OCC}	°F	Existing temperature of space during occupied hours
n_{Boiler}	-	Existing system efficiency
t_{HOOD}	Hrs	Existing Hood Run Hours
t_{OCC}	Hrs	Occupied Bin Hours
HD_{OCC}	Hrs	Existing occupied heating degree hours

* Inputs are in blue

Building	Kitchen Hood Area (ft^2)	HP of Exhaust Fan Motor	HP of MAU Motor	Annual Run Hours	System Efficiency	Current Exhaust Volume (CFM)
Building 1/2/3/5/6	48	5.0	3.0	2,160	60%	3,600
Building 1/2/3/5/6	56	3.0	1.5	2,160	60%	4,200

Morris County Vo-Tech
Exhibit D
ECM 2D Kitchen Hood Controls
Kitchen Hood Replacement

Building 1/2/3/5/6	48	5.0	3.0	2,160	60%	3,600
Totals	**152**	**13.0**	**7.5**			**11,400**

	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6
Kitchen Hood Area	48	56	48
HP of Fan Motor	5	3.0	5.0
HP Fan MAU Motor	3.0	1.5	3.0
Load Factor	75%	75%	75%
Annual Run Hours	2,160	2,160	2,160
System Efficiency	60%	60%	60%
Current Exhaust Volume	3,600	4,200	3,600
Proposed Exhaust Volume	2,322	2,709	2,322
Existing Heat Load	2,243	2,616	2,243
Proposed Heat Load	1,446	1,688	1,446
Existing Occupied Heating Setpoint	71.0	71.0	71.0
Existing Occupied Cooling Setpoint	73.0	73.0	73.0
Existing Unoccup. Cooling Setpoint	77.5	77.5	77.5
Boiler Efficiency	78.0%	78.0%	78.0%
Safety Factor	0%	0%	0%
Electrical Savings	6,555	3,687	6,555
Thermal Savings	1,021	1,191	1,021

ELECTRICAL CALCULATIONS

BUILDING 1/2/3/5/6

Variable Exhaust Volume Analysis

% Rated RPM	% Run Time	Time Hrs/Yr	Weighted RPM	Existing kWh	Proposed kWh	kWh Savings
100%	10%	216	10.0%	967	967	0
90%	5%	108	5%	483	352	131
80%	5%	108	4%	483	248	236
70%	15%	324	11%	1,450	497	953
60%	30%	648	18%	2,900	626	2,274
50%	35%	756	18%	3,384	423	2,961
40%	0%	-	0%	0	0	0
30%	0%	-	0%	0	0	0

Morris County Vo-Tech
Exhibit D
ECM 2D Kitchen Hood Controls
Kitchen Hood Replacement

20%	0%	-	0%	0	0	0
10%	0%	-	0%	0	0	0
Total		2,160	**65%**	**9,668**	**3,114**	**6,555**

BUILDING 1/2/3/5/6

Variable Exhaust Volume Analysis

% Rated RPM	% Run Time	Time Hrs/Yr	Weighted RPM	Existing kWh	Proposed kWh	kWh Savings
100%	10%	216	10%	544	544	0
90%	5%	108	5%	272	198	74
80%	5%	108	4%	272	139	133
70%	15%	324	11%	816	280	536
60%	30%	648	18%	1,632	352	1,279
50%	35%	756	18%	1,903	238	1,665
40%	0%	-	0%	0	0	0
30%	0%	-	0%	0	0	0
20%	0%	-	0%	0	0	0
10%	0%	-	0%	0	0	0
Total		2,160	**65%**	**5,438**	**1,751**	**3,687**

BUILDING 1/2/3/5/6

Variable Exhaust Volume Analysis

% Rated RPM	% Run Time	Time Hrs/Yr	Weighted RPM	Existing kWh	Proposed kWh	kWh Savings
100%	10%	216	10%	967	967	0
90%	5%	108	5%	483	352	131
80%	5%	108	4%	483	248	236
70%	15%	324	11%	1,450	497	953
60%	30%	648	18%	2,900	626	2,274
50%	35%	756	18%	3,384	423	2,961
40%	0%	-	0%	0	0	0
30%	0%	-	0%	0	0	0
20%	0%	-	0%	0	0	0
10%	0%	-	0%	0	0	0
Total		2,160	**65%**	**9,668**	**3,114**	**6,555**

Morris County Vo-Tech
Exhibit D
ECM 2E Walk In Compressor Controls
Walk-In Freezer/Cooler Controllers

ECM DESCRIPTION

Installation of a refrigeration controller made by intellidyne on walk-in freezers and refrigerators. This will reduce cycling and improve operating efficiency of the compressor.

DATA / ASSUMPTIONS

Assumed compressor and controller savings	15%	
Assumed Run Hours	4,200	Hours

MEASUREMENT AND VERIFICATION

Option A - Measure kW of selected freezer compressors. Logging compressor operation before and after the controller installations. Calculate savings based on measured results.

COMMISSIONING

Test compressors after installation.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

Recovery factor taken at 0 due to few installations and not proven savings record.

FORMULAE

$$W_{SAVINGS} = (\ kW_{REFRIG} + kW_{FREEZER}\ ) \cdot t \cdot \delta_{\%SAVINGS}$$

Variable	Units	Description
$W_{savings}$	kWh	Electrical Savings for Motor Replacement
kW_{REFRIG}	kW	Horsepower of motor
$kW_{FREEZER}$	kW	Existing Run Hours
t	Hrs	Run hours (assumed)
$\delta_{\%SAVINGS}$	%	Compressor and controller savings (assumed)

*Inputs are blue

Morris County Vo-Tech
Exhibit D
ECM 2E Walk In Compressor Controls
Walk-In Freezer/Cooler Controllers

Building	Location	No. of Walk-In Refrigators	No. of Walk-In Freezers	kW of Refrigator	kW of Freezer
Building 1/2/3/5/6	Bldg1 Kitchen	1	-	1.152	
Building 1/2/3/5/6	Bldg1 Kitchen	-	1		2.863
Building 4	Bldg 4 Kitchen	-	1		2.863
Building 4	Bldg 4 Kitchen	1	-	1.152	
Totals	-	**2**	**2**	**2.3**	**5.7**

CALCULATIONS

	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 4	Building 4
No. of Walk-In Refrigerators	1	0	0	1
No. of Walk-In Freezers	0	1	1	0
kW of Refrigerator	1.152	-	-	1.152
kW of Freezer	-	2.863	2.863	-
Run Hours	4,200	4,200	4,200	4,200
Total Electrical Consumption	4,838	12,025	12,025	4,838
Compressor and Controller Savings	15%	15%	15%	15%
Safety Factor	0%	0%	0%	0%
Electrical Savings	726	1,804	1,804	726

Morris County Vo-Tech
Exhibit D
ECM 3A Demand Control Ventilation
Demand Control Ventilation

ECM DESCRIPTION

Install CO2 sensors in large areas to control fresh air intake

DATA / ASSUMPTIONS

Heating Hours 3,863 Hours

*Schedules and temperatures are based on data logging trends performed throughout the building
* Proposed setpoints are used as to not capture thermal savings twice

MEASUREMENT AND VERIFICATION

Option A - Verify savings based on programmed parameters and engineering calculations.

COMMISSIONING

Simulate function of CO2 control signal. Test all equipment involved in DCV, which will include but not limited to testing function of fresh air damper response to the CO2 sensor signal and sequence of operation per design (Override CO2 signal during the building warm up, etc.).

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables.

FORMULAE

$$W_{SAVINGS} = \sum_{-5}^{60} [(kW_{FAN} \cdot t_{OCC}) - (kW_{FAN} \cdot (1 - RPM_{-\%})^{2.8}) \cdot t_{OCC}]$$

$$Q_{SAVINGS} = \sum_{-5}^{60} \{ [Q_{LOAD} \cdot t_{OCC} \cdot (1 - OA_{\%OCC})] + [Q_{LOAD} \cdot t_{UNOCC} \cdot (1 - OA_{\%UNOCC})] \} / \eta_{BOILER}$$

$$Q_{LOAD} = 1.08 \cdot CFM_{OA} \cdot (T_{OCC} - T_{BIN}) / 1000$$

Variable	Units	Description
$W_{SAVINGS}$	kWh	Annual kWh Savings
$Q_{SAVINGS}$	Therms	Annual Thermal Savings
Q_{LOAD}	Mmbtu	Thermal Load of unit at respective temperature bin
kW_{FAN}	kW	Total kW of Fan
$\sum_{-5}^{60}$	-	Summation of all bins from -5°F to 60°F
T_{BIN}	°F	Temperature of respective bin
t_{OCC}	Hrs	Proposed occupied Bin Hours in respective temperature bin
t_{UNOCC}	Hrs	Proposed unoccupied Bin Hours in respective temperature bin
$RPM_{-\%}$	%	Percentage of RPM fan will be reduced due to VFD
$OA_{\%OCC}$	%	Percentage Fresh Air Reduction during occupied hours
$OA_{\%UNOCC}$	%	Percentage Fresh Air Reduction during unoccupied hours
CFM_{SUPPLY}	CFM	Total supply CFM of units
CFM_{OA}	CFM	Total outside air CFM of units
T_{OCC}	°F	Proposed occupied Temperature
T_{UNOCC}	°F	Proposed unoccupied Temperature
$T_{OCC/UNOCC}$	°F	Proposed occupied/unoccupied Mode Temperature for controlled unit
η_{BOILER}	%	Boiler Efficiency

* Inputs are in blue

Building	Area Served	Qty	HP (Each)	Supply CFM (Each)	OA CFM (Each)
Building 1/2/3/5/6	Room 302A - Veterinary Science	1	7.5	8,000	1,600
Building 1/2/3/5/6	Buildings & Ground Office	1	5.0	5,000	1,000
Building 1/2/3/5/6	Room 306 - Plumbing	1	2.0	4,000	800
Building 1/2/3/5/6	Room 305 - Electrical Trades	1	5.0	7,000	1,400
Building 1/2/3/5/6	Room 303 - Building Construction	1	2.0	4,000	800

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Demand Control Ventilation

Building 1/2/3/5/6	Room 304 - Carpentry	1	5.0	7,000	1,400
Building 1/2/3/5/6	Room 301	1	1.5	1,500	400
Building 4	Room 403A	1	1.5	1,500	400
Building 4	Room 402A	1	1.5	1,500	400
Building 4	Room 404A	1	1.5	1,500	400
Building 4	Room 405A	1	1.5	1,500	400
Building 4	Room 401A	1	1.5	1,500	400
Building 4	Room 408A	1	1.5	1,500	400
Building 4	Room 409A	1	1.5	1,500	400
Totals		**14**	**38.5**	**47,000**	**13,800**

	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 1/2/3/5/6	Building 4	Building 4	Building 4	Building 4	Building 4	Building 4	Building 4
Location	Room 302A - Veterinary Science	Buildings & Ground Office	Room 306 - Plumbing	Room 305 - Electrical Trades	Room 303 - Building Construction	Room 304 - Carpentry	Room 301	Room 403A	Room 402A	Room 404A	Room 405A	Room 401A	Room 408A	Room 409A
Quantity	1	1	1	1	1	1	1	1	1	1	1	1	1	1
HP Motor Total	7.5	5	2	5	2	5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Motor Load Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
kW Motor Total	3.64	2.42	0.97	2.42	0.97	2.42	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
CFM Total	8,000	5,000	4,000	7,000	4,000	7,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Outside Air Total	1,600	1,000	800	1,400	800	1,400	400	400	400	400	400	400	400	400
**Proposed Occupied Heating Setpoint	71.0	71	71	71	71	71	71	71	71	71	71	71	71	71
**Proposed Unoccup. Heating Setpoint	66.5	67	67	67	67	67	67	65	65	65	65	65	65	65
**Proposed Occupied Cooling Setpoint	73.0	73	73	73	73	73	73	73	73	73	73	73	73	73
**Proposed Unoccup. Cooling Setpoint	77.5	78	78	78	78	78	78	79	79	79	79	79	79	79
Existing Boiler Efficiency	78.0%	78.0%	78.0%	78.0%	78.0%	78.0%	78.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%
Average Fan Speed Reduction	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Average Occupied Heating Reduction	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Average Unoccupied Heating Reduction	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Safety Factor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Electrical Savings	5,746	3,831	1,532	3,831	1,532	3,831	3,831	1,149	1,149	1,149	1,149	1,149	1,149	1,149
Thermal Savings	709	443	354	620	354	620	177	140	140	140	140	140	140	140

CALCULATIONS

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	1,600	16	563	0.8	0.9	21
50 to 55	52.5	131	253	181	565	415	150	1,600	24	954	2.0	1.8	49
45 to 50	47.5	117	180	134	431	308	123	1,600	33	707	2.0	2.0	52
40 to 45	42.5	169	194	221	584	396	189	1,600	41	909	3.3	3.9	92
35 to 40	37.5	215	186	247	648	421	227	1,600	50	967	4.2	5.7	127
30 to 35	32.5	260	111	196	567	331	236	1,600	59	760	3.9	6.9	139
25 to 30	27.5	144	59	119	322	187	135	1,600	67	430	2.5	4.5	91
20 to 25	22.5	140	20	69	229	116	113	1,600	76	266	1.8	4.3	78
15 to 20	17.5	66	21	16	103	56	47	1,600	85	128	0.9	2.0	38
10 to 15	12.5	26	3	19	48	25	23	1,600	93	57	0.5	1.1	20
5 to 10	7.5	3	-	1	4	2	2	1,600	102	4	0.0	0.1	2
0 to 5	2.5	2	-	-	2	1	1	1,600	111	2	0.0	0.1	1
-5 to 0	-2.5	-	-	-	-	-	-	1,600	119	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,600	128	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,600	137	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			5,746	22		709

BUILDING 1/2/3/5/6

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Exhibit D
ECM 3A Demand Control Ventilation
Demand Control Ventilation

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	1,000	10	375	0.5	0.6	13
50 to 55	52.5	131	253	181	565	415	150	1,000	15	636	1.3	1.1	31
45 to 50	47.5	117	180	134	431	308	123	1,000	21	471	1.3	1.3	32
40 to 45	42.5	169	194	221	584	396	189	1,000	26	606	2.1	2.4	58
35 to 40	37.5	215	186	247	648	421	227	1,000	31	645	2.6	3.6	79
30 to 35	32.5	260	111	196	567	331	236	1,000	37	507	2.4	4.3	87
25 to 30	27.5	144	59	119	322	187	135	1,000	42	287	1.6	2.8	57
20 to 25	22.5	140	20	69	229	116	113	1,000	48	177	1.1	2.7	49
15 to 20	17.5	66	21	16	103	56	47	1,000	53	85	0.6	1.3	24
10 to 15	12.5	26	3	19	48	25	23	1,000	58	38	0.3	0.7	12
5 to 10	7.5	3	-	1	4	2	2	1,000	64	3	0.0	0.1	1
0 to 5	2.5	2	-	-	2	1	1	1,000	69	1	0.0	0.0	1
-5 to 0	-2.5	-	-	-	-	-	-	1,000	75	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,000	80	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,000	85	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			3,831	14		443

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	800	8	150	0.4	0.4	11
50 to 55	52.5	131	253	181	565	415	150	800	12	254	1.0	0.9	24
45 to 50	47.5	117	180	134	431	308	123	800	16	188	1.0	1.0	26
40 to 45	42.5	169	194	221	584	396	189	800	21	242	1.6	2.0	46
35 to 40	37.5	215	186	247	648	421	227	800	25	258	2.1	2.8	64
30 to 35	32.5	260	111	196	567	331	236	800	29	203	1.9	3.5	69
25 to 30	27.5	144	59	119	322	187	135	800	34	115	1.3	2.3	45
20 to 25	22.5	140	20	69	229	116	113	800	38	71	0.9	2.2	39
15 to 20	17.5	66	21	16	103	56	47	800	42	34	0.5	1.0	19
10 to 15	12.5	26	3	19	48	25	23	800	47	15	0.2	0.5	10
5 to 10	7.5	3	-	1	4	2	2	800	51	1	0.0	0.1	1
0 to 5	2.5	2	-	-	2	1	1	800	55	0	0.0	0.0	1
-5 to 0	-2.5	-	-	-	-	-	-	800	60	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	800	64	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	800	68	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,532	11		354

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	1,400	14	375	0.7	0.8	19
50 to 55	52.5	131	253	181	565	415	150	1,400	21	636	1.8	1.6	43
45 to 50	47.5	117	180	134	431	308	123	1,400	29	471	1.8	1.8	45
40 to 45	42.5	169	194	221	584	396	189	1,400	36	606	2.9	3.4	81
35 to 40	37.5	215	186	247	648	421	227	1,400	44	645	3.7	5.0	111
30 to 35	32.5	260	111	196	567	331	236	1,400	51	507	3.4	6.1	121
25 to 30	27.5	144	59	119	322	187	135	1,400	59	287	2.2	4.0	79
20 to 25	22.5	140	20	69	229	116	113	1,400	67	177	1.5	3.8	68
15 to 20	17.5	66	21	16	103	56	47	1,400	74	85	0.8	1.8	33
10 to 15	12.5	26	3	19	48	25	23	1,400	82	38	0.4	1.0	17
5 to 10	7.5	3	-	1	4	2	2	1,400	89	3	0.0	0.1	2
0 to 5	2.5	2	-	-	2	1	1	1,400	97	1	0.0	0.1	1
-5 to 0	-2.5	-	-	-	-	-	-	1,400	104	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,400	112	0	0.0	0.0	0

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-15 to -10	-12.5	-	-	-	-	-	-	1,400	119	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			3,831	19		620

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	800	8	150	0.4	0.4	11
50 to 55	52.5	131	253	181	565	415	150	800	12	254	1.0	0.9	24
45 to 50	47.5	117	180	134	431	308	123	800	16	188	1.0	1.0	26
40 to 45	42.5	169	194	221	584	396	189	800	21	242	1.6	2.0	46
35 to 40	37.5	215	186	247	648	421	227	800	25	258	2.1	2.8	64
30 to 35	32.5	260	111	196	567	331	236	800	29	203	1.9	3.5	69
25 to 30	27.5	144	59	119	322	187	135	800	34	115	1.3	2.3	45
20 to 25	22.5	140	20	69	229	116	113	800	38	71	0.9	2.2	39
15 to 20	17.5	66	21	16	103	56	47	800	42	34	0.5	1.0	19
10 to 15	12.5	26	3	19	48	25	23	800	47	15	0.2	0.5	10
5 to 10	7.5	3	-	1	4	2	2	800	51	1	0.0	0.1	1
0 to 5	2.5	2	-	-	2	1	1	800	55	0	0.0	0.0	1
-5 to 0	-2.5	-	-	-	-	-	-	800	60	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	800	64	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	800	68	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,532	11		354

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	1,400	14	375	0.7	0.8	19
50 to 55	52.5	131	253	181	565	415	150	1,400	21	636	1.8	1.6	43
45 to 50	47.5	117	180	134	431	308	123	1,400	29	471	1.8	1.8	45
40 to 45	42.5	169	194	221	584	396	189	1,400	36	606	2.9	3.4	81
35 to 40	37.5	215	186	247	648	421	227	1,400	44	645	3.7	5.0	111
30 to 35	32.5	260	111	196	567	331	236	1,400	51	507	3.4	6.1	121
25 to 30	27.5	144	59	119	322	187	135	1,400	59	287	2.2	4.0	79
20 to 25	22.5	140	20	69	229	116	113	1,400	67	177	1.5	3.8	68
15 to 20	17.5	66	21	16	103	56	47	1,400	74	85	0.8	1.8	33
10 to 15	12.5	26	3	19	48	25	23	1,400	82	38	0.4	1.0	17
5 to 10	7.5	3	-	1	4	2	2	1,400	89	3	0.0	0.1	2
0 to 5	2.5	2	-	-	2	1	1	1,400	97	1	0.0	0.1	1
-5 to 0	-2.5	-	-	-	-	-	-	1,400	104	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	1,400	112	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	1,400	119	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			3,831	19		620

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	4	375	0.2	0.2	5
50 to 55	52.5	131	253	181	565	415	150	400	6	636	0.5	0.5	12
45 to 50	47.5	117	180	134	431	308	123	400	8	471	0.5	0.5	13
40 to 45	42.5	169	194	221	584	396	189	400	10	606	0.8	1.0	23
35 to 40	37.5	215	186	247	648	421	227	400	13	645	1.1	1.4	32
30 to 35	32.5	260	111	196	567	331	236	400	15	507	1.0	1.7	35
25 to 30	27.5	144	59	119	322	187	135	400	17	287	0.6	1.1	23

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20 to 25	22.5	140	20	69	229	116	113	400	19	177	0.4	1.1	19
15 to 20	17.5	66	21	16	103	56	47	400	21	85	0.2	0.5	9
10 to 15	12.5	26	3	19	48	25	23	400	23	38	0.1	0.3	5
5 to 10	7.5	3	-	1	4	2	2	400	25	3	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	28	1	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	30	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	32	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	34	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			3,831	5		177

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4

Morris County Vo-Tech
Exhibit D
ECM 3A Demand Control Ventilation
Demand Control Ventilation

50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

Morris County Vo-Tech
Exhibit D
ECM 3A Demand Control Ventilation
Demand Control Ventilation

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

BUILDING 4

Amb. Temp Bin °F	Ave Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Bin Hours	Unoccupied Bin Hours	Outside Air Flowrate CFM	OA Air Load MBH	Annual Fan Electrical Savings	Annual Occupied Heating Savings	Annual Unoccupied Heating Savings	Total Savings Therms
HEATING													
55 to 60	57.5	113	129	118	360	245	115	400	3	113	0.2	0.2	4
50 to 55	52.5	131	253	181	565	415	150	400	5	191	0.4	0.4	9
45 to 50	47.5	117	180	134	431	308	123	400	8	141	0.5	0.5	10
40 to 45	42.5	169	194	221	584	396	189	400	10	182	0.8	0.9	18
35 to 40	37.5	215	186	247	648	421	227	400	12	193	1.0	1.3	25
30 to 35	32.5	260	111	196	567	331	236	400	14	152	0.9	1.7	28
25 to 30	27.5	144	59	119	322	187	135	400	16	86	0.6	1.1	18
20 to 25	22.5	140	20	69	229	116	113	400	18	53	0.4	1.0	16
15 to 20	17.5	66	21	16	103	56	47	400	21	26	0.2	0.5	8
10 to 15	12.5	26	3	19	48	25	23	400	23	11	0.1	0.3	4
5 to 10	7.5	3	-	1	4	2	2	400	25	1	0.0	0.0	0
0 to 5	2.5	2	-	-	2	1	1	400	27	0	0.0	0.0	0
-5 to 0	-2.5	-	-	-	-	-	-	400	29	0	0.0	0.0	0
-10 to -5	-7.5	-	-	-	-	-	-	400	31	0	0.0	0.0	0
-15 to -10	-12.5	-	-	-	-	-	-	400	33	0	0.0	0.0	0
Total		1,386	1,156	1,321	3,863	2,501	1,362			1,149	5		140

Morris County Vo-Tech
Exhibit D
ECM 4A Building Envelope Improvements
Building Envelope Improvements

ECM DESCRIPTION

Reduce building infiltration by weather stripping doors, sealing roof & wall joints, duct & piping penetrations, skylight perimeters and window corners.

DATA / ASSUMPTIONS

*Crack area determined by survey team

MEASUREMENT AND VERIFICATION
Option A - Energy saving calculations based on programmed parameters

COMMISSIONING

Visual inspection per scope of work from subcontractor. Inspection might include smoke test.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	0%
Safety Factor (Thermal) =	0%

Recovery factor taken at 10% due to the uncertainty of variables incorporated in the savings calculations

FORMULAE

$H = (K * Q_{INF} * (dp)^n * HDD * 10) / 28{,}900$ where 28,900 = Heating efficiency factor = (1,000,000 Btu per MMBtu / (1.08 * 24 hr/day)) * 75% std htg efficiency

$C = T * C2 * CDD$ where $T = C1 * Q_{INF} * h$

$Q_{INF} = K * dp^n * A_{CRACK}$

$dp^n = 5.16$

$A_{CRACK} = A_{VENTS} + A_{WIN} + A_{RTU} + A_{DOORS} + A_{BULK} + A_{ROOF/WALL}$

Variable	Units	Description
H	therms	Thermal Savings associated with air infiltration reduction
C	kWh	Electrical Savings associated with air infiltration reduction
Q_{INF}	cfm	Infiltration air flow savings
A_{CRACK}	ft^2	Total square feet of infiltration area
K	$(ft^3 / min) / (Pa * ft^2)$	Flow Factor
dp^n	Pa	Pressure difference across building envelope raised to nth power
CDD	$(^oF\text{-}Day)/Yr$	Cooling degree days
T	tons	Cooling load
h	Btu/lb	Avg. enthalpy of air
HDD	(°F-Day)/Yr	Annual heating degree days
C1	$lb/ft^3 * min/hr$	Cooling Constant = std air density 0.075 lb/ft^3 * 60 min/hr
C2	kW/ton	Cooling system characteristic power consumption
A_{VENTS}	ft^2	Total square feet of infiltration spaces with regards to vents
A_{WIN}	ft^2	Total square feet of infiltration spaces with regards to windows
A_{RTU}	ft^2	Total square feet of infiltration spaces with regards to RTU's
A_{DOORS}	ft^2	Total square feet of infiltration spaces with regards to doors
A_{BULK}	ft^2	Total square feet of infiltration spaces with regards to bulkheads
$A_{ROOF/WALL}$	ft^2	Total square feet of infiltration spaces with regards to the wall roof joint

Very Good
Good
Average
Poor
Loose

Morris County Vo-Tech
Exhibit D
ECM 4A Building Envelope Improvements
Building Envelope Improvements

Source: Public Works Canada Standards & Guidelines,: EC128 April 30, 1980

ASSUMPTIONS / DATA

Subcontractor Calculations y * If Yes - Please Refer to tab 'Sub BEI Calculation' for details

Subcontractor Calculated Savings

Building	kWh Savings	Thermal Savings	De-Rate Applied to Sub Calcs	kWh Savings	Thermal Savings
Building 1/2/3/5/6	9,126	7,305	0%	9,126	7,305
Building 4	3,510	5,440	0%	3,510	5,440
				-	-
				-	-
				-	-
				-	-
Totals	**12,636**	**12,745**		12,636	12,745

CALCULATIONS

Building Envelope Improvements	
Envelope Tightness	
Tightness Multiplier	
Cooling Savings Applicable	
Heating Savings Diversity Factor	
Flow Factor	
(AP)^n	
Crack Area	
Air Leakage (CFM)	
Heating Degree Days	
Heating Efficiency Factor	
Cooling Savings Diversity Factor	
Constant	
CFM	
Enthalpy	
Tons	
Constant	
CDD	
kWh	
Therms	
Electric Safety Factor	
Thermal Safety Factor	
kWh Savings	
Thermal Savings	

Morris County Vo-Tech
Exhibit D
ECM 4B Roof Replacement
Roof Replacement

ECM DESCRIPTION

Furnish and install a Spray Polyurethane Foam (SPF) roofing system as manufactured by Covestro or equal.

DATA / ASSUMPTIONS

Heating Hours 3,863 Hours

Building Existing Roof is in satisfactory condition and can be overlayed with little or no repairs
-15%+ loss in thermal resistance due to thermal shorts of steel fasteners
-10% increase in thermal transmittance when using single layer of insulation board
-R-value & Air permeability of a deck, insulation & membrane has a major impact on System R-value

*U Factors for the new roof was obtained by manufacturer and product data. U Factors for the existing roof is based on construction type and material

MEASUREMENT AND VERIFICATION

Option A - Savings based on Engineering Calculations

COMMISSIONING

Verify area of new roof installed.

RECOVERY/SAFETY FACTOR

Recovery/Safety Factor (Electric) =	0%
Recovery/Safety Factor (Thermal) =	0%

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables. The heating fuel savings calculations are based upon information provided by the equipment vendor.

FORMULAE

$$Q_{SAVINGS} = (Q_C - Q_c) + Q_{INF}$$

$$Q_{INF} = \sum_{-5}^{100} (1.08 \cdot (i_{ROOF} - i_{ROOF}) \cdot (T_{W/S} - T_{BIN}) \cdot l_R \cdot t_{BIN}) / 100{,}000$$

$$Q_C = \sum_{-5}^{100} ((T_{W/S} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{BIN}) / 100{,}000$$
$$Q_C = \sum_{-5}^{100} ((T_{W/S} - T_{BIN}) \cdot A_{ROOF} \cdot U_{ROOF} \cdot t_{BIN}) / 100{,}000$$

*Note W/S designates use of either winter building setpoint or summer building setpoint with the appropiate bin

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
Q_C	Therms	Conductive/convective cooling gain and heating loss with existing windows
Q_C	Therms	Conductive/convective cooling gain and heating loss with proposed windows
Q_{INF}	Therms	Infiltration savings with proposed windows
$\sum_{-5}^{100}$	-	Summation of all bins from -5°F to 100°F
T_W	°F	Winter building setpoint
T_S	°F	Summer building setpoint
T_{BIN}	°F	Temperature of respective bin
t_{BIN}	Hrs	Hrs in respective bin
A_{ROOF}	ft^2	Existing unoccupied Bin Hours in respective temperature bin
U_{ROOF}	btu / ft^2 / °F	Existing U-factor of roof
U_{ROOF}	btu / ft^2 / °F	Proposed U-factor of roof
i_{ROOF}	Cfm/ft	Infiltration constant for existing windows
i_{ROOF}	Cfm/ft	Infiltration constant for proposed windows
l_R	ft	Linear feet of curtain wall

* Inputs are in blue

Morris County Vo-Tech
Exhibit D
ECM 4B Roof Replacement
Roof Replacement

Building	Roof ft^2 Audited	Air permability Factor of Deck. Insulation, membrane (-100%-0)	Thermal Transmittance Increase (-20-0%)	Thermal Shorts due to Steel Fastners (-15%-0)	R - Value of Existing Roofing Materials	R - Value of Existing Roof	U Factor of Existing Roof	R - Value of Proposed Roof	U Factor of Proposed Roof	Infiltration of Existing Roof (0-100%)	Infiltration of Proposed Roof ((0-100%)	EER of Cooling System (Average)
Building 1/2/3/5/6	0	-50%	-10%	-15%	18.00	4.50	0.22	-	#DIV/0!	50%	0%	11.0
Building 4	16,950	-50%	-10%	-15%	18.00	4.50	0.22	14.10	0.07	50%	20%	11.0
Totals												

	Building 1/2/3/5/6	Building 4
Roof ft^2 Audited	0	16,950
U of Existing Roof	0.22	0.22
U of Proposed Roof	#DIV/0!	0.07
Infiltration of Existing Roofs	0.50	0.50
Infiltration of Proposed Roofs	-	0.20
Total Linear Ft of Perimeter	-	944
EER of Cooling System (Average)	11.0	11.0
Existing Occupied Heating Setpoint	71.0	71.0
Existing Unoccup. Heating Setpoint	66.5	65.0
Existing Occupied Cooling Setpoint	73.0	73.0
Existing Unoccup. Cooling Setpoint	77.5	79.0
Boiler Efficiency	78.0%	93.0%
Safety Factor	0%	0%
Electrical Savings	-	7,104
Thermal Savings	#DIV/0!	2,794

CALCULATIONS

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Hours	Unoccupied Hours	Roof Square Feet	Existing Occupied Cooling Gain and Heating Loss	Existing Unoccupied Cooling Gain and Heating Loss	Proposed Occupied Cooling Gain and Heating Loss	Proposed Unoccupied Cooling Gain and Heating Loss	Cooling or Heating Savings	Infiltration savings	Total Heating or Cooling Savings	Safety Factor	kWh Saved	Input Therms Saved
COOLING									(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)			
100 to 105	102.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	
95 to 100	97.5	-	5	-	5	5	-	-	-	-	-	-	-	-	-	0%	-	
90 to 95	92.5	-	34	2	36	35	1	-	-	-	-	-	-	-	-	0%	-	
85 to 90	87.5	1	100	27	128	117	11	-	-	-	-	-	-	-	-	0%	-	
80 to 85	82.5	17	328	92	437	392	45	-	-	-	-	-	-	-	-	0%	-	
75 to 80	77.5	106	270	200	576	435	141	-	-	-	-	-	-	-	-	0%	-	
70 to 75	72.5	226	185	248	659	425	234	-	-	-	-	-	-	-	-	0%	-	
65 to 70	67.5	245	207	283	735	476	259	-	-	-	-	-	-	-	-	0%	-	
60 to 65	62.5	348	154	240	742	435	308	-	-	-	-	-	-	-	-	0%	-	
HEATING																		
55 to 60	57.5	113	129	118	360	245	115	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
50 to 55	52.5	131	253	181	565	415	150	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
45 to 50	47.5	117	180	134	431	308	123	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
40 to 45	42.5	169	194	221	584	396	189	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
35 to 40	37.5	215	186	247	648	421	227	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
30 to 35	32.5	260	111	196	567	331	236	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
25 to 30	27.5	144	59	119	322	187	135	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
20 to 25	22.5	140	20	69	229	116	113	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
15 to 20	17.5	66	21	16	103	56	47	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
10 to 15	12.5	26	3	19	48	25	23	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
5 to 10	7.5	3	-	1	4	2	2	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
0 to 5	2.5	2	-	-	2	1	1	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
-5 to 0	-2.5	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
-10 to -5	-7.5	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
-15 to -10	-12.5	-	-	-	-		-	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	-	#DIV/0!	0%		#DIV/0!
Total		2,329	2,439	2,413	7,181	4,821	2,361										-	#DIV/0!

BUILDING 4

Morris County Vo-Tech
Exhibit D
ECM 4B Roof Replacement
Roof Replacement

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Hours	Unoccupied Hours	Roof Square Feet	Existing Occupied Cooling Gain and Heating Loss	Existing Unoccupied Cooling Gain and Heating Loss	Proposed Occupied Cooling Gain and Heating Loss	Proposed Unoccupied Cooling Gain and Heating Loss	Cooling or Heating Savings	Infiltration savings	Total Heating or Cooling Savings	Safety Factor	kWh Saved	Input Therms Saved
COOLING									(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)			
100 to 105	102.5	-	-	-	-	-	-	16,950	-	-	-	-	-	-	-	0%	-	
95 to 100	97.5	-	5	-	5	5	-	16,950	0.5	-	0.2	-	0.3	0.0	0.4	0%	109	
90 to 95	92.5	-	34	2	36	35	1	16,950	2.8	0.0	0.9	0.0	2.0	0.1	2.1	0%	615	
85 to 90	87.5	1	100	27	128	117	11	16,950	7.0	0.4	2.2	0.1	5.0	0.3	5.3	0%	1,566	
80 to 85	82.5	17	328	92	437	392	45	16,950	15.3	0.6	4.9	0.2	10.9	0.5	11.3	0%	3,318	
75 to 80	77.5	106	270	200	576	435	141	16,950	8.0	-	2.6	-	5.5	-	5.5	0%	1,604	
70 to 75	72.5	226	185	248	659	425	234	16,950	-	-	-	-	-	-	-	0%	-	
65 to 70	67.5	245	207	283	735	476	259	16,950	-	-	-	-	-	-	-	0%	-	
60 to 65	62.5	348	154	240	742	435	308	16,950	-	-	-	-	-	-	-	0%	-	
HEATING																		
55 to 60	57.5	113	129	118	360	245	115	16,950	12.5	0.4	4.0	1.0	9.1	0.8	9.9	0%		107
50 to 55	52.5	131	253	181	565	415	150	16,950	28.9	0.6	9.2	2.3	21.4	2.2	23.5	0%		253
45 to 50	47.5	117	180	134	431	308	123	16,950	27.2	0.5	8.7	2.6	20.7	2.3	23.0	0%		247
40 to 45	42.5	169	194	221	584	396	189	16,950	42.5	0.7	13.6	5.1	33.3	4.0	37.3	0%		401
35 to 40	37.5	215	186	247	648	421	227	16,950	53.1	0.9	17.0	7.5	42.8	5.5	48.3	0%		519
30 to 35	32.5	260	111	196	567	331	236	16,950	48.0	0.9	15.3	9.2	41.0	5.6	46.6	0%		502
25 to 30	27.5	144	59	119	322	187	135	16,950	30.7	0.5	9.8	6.1	26.5	3.7	30.2	0%		324
20 to 25	22.5	140	20	69	229	116	113	16,950	21.1	0.4	6.7	5.8	19.7	3.0	22.7	0%		244
15 to 20	17.5	66	21	16	103	56	47	16,950	11.2	0.2	3.6	2.7	10.2	1.5	11.7	0%		125
10 to 15	12.5	26	3	19	48	25	23	16,950	5.4	0.1	1.7	1.5	5.1	0.8	5.9	0%		63
5 to 10	7.5	3	-	1	4	2	2	16,950	0.4	0.0	0.1	0.2	0.4	0.1	0.5	0%		5
0 to 5	2.5	2	-	-	2	1	1	16,950	0.2	0.0	0.1	0.1	0.2	0.0	0.3	0%		3
-5 to 0	-2.5	-	-	-	-	-	-	16,950	-	-	-	-	-	-	-	0%		-
-10 to -5	-7.5	-	-	-	-	-	-	16,950	-	-	-	-	-	-	-	0%		-
-15 to -10	-12.5	-	-	-	-		-	16,950	-	-	-	-	-	-	-	0%		-
Total		2,329	2,439	2,413	7,181	4,821	2,361										7,104	2,794

Morris County Vo-Tech
Exhibit D
ECM 4C Window Replacements
Window Replacement

ECM DESCRIPTION

Replacement of windows with double-pane, low-e, metal frame windows.

DATA / ASSUMPTIONS

Recovery/Safety Factor (Electric) =	0%	
Recovery/Safety Factor (Thermal) =	0%	
Heating Hours	3,863	Hours

*U Factors for the new windows are obtained by manufacturer data. U Factors for the existing windows are based on type, material, and thickness

MEASUREMENT AND VERIFICATION
Option A - Energy Savings based on Engineering Calculations

COMMISSIONING

Verify quantities installed and total square feet.

RECOVERY/SAFETY FACTOR

Savings calculations are based on weather bin data, fresh air flows and temperature setpoints. A more conservative of 0 percent is used for this ECM due to the uncertainty of variables. The heating fuel savings calculations are based upon information provided by the equipment vendor.

FORMULAE

$$Q_{SAVINGS} = (Q_C - Q_C) + Q_{INF}$$

$$Q_{INF} = \sum_{-5}^{100} \left(1.08 \cdot (i_{WIN} - i_{WIN}) \cdot (T_{W/S} - T_{BIN}) \cdot l_W \cdot t_{BIN} \right) / 100{,}000$$

$$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{BIN} \right) / 100{,}000$$

$$Q_C = \sum_{-5}^{100} \left((T_{W/S} - T_{BIN}) \cdot A_{WIN} \cdot U_{WIN} \cdot t_{BIN} \right) / 100{,}000$$

*Note W/S designates use of either winter building setpoint or summer building setpoint with the appropiate bin

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
Q_C	Therms	Conductive/convective cooling gain and heating loss with existing windows
Q_C	Therms	Conductive/convective cooling gain and heating loss with proposed windows
Q_{INF}	Therms	Infiltration savings with proposed windows
$\sum_{-5}^{100}$	-	Summation of all bins from -5°F to 100°F
T_W	°F	Winter building setpoint
T_S	°F	Summer building setpoint
T_{BIN}	°F	Temperature of respective bin
t_{BIN}	Hrs	Hrs in respective bin
A_{WIN}	ft^2	Existing unoccupied Bin Hours in respective temperature bin
U_{WIN}	btu / ft^2 / °F	Existing U-factor of roof
U_{WIN}	btu / ft^2 / °F	Proposed U-factor of roof
i_{WIN}	Cfm/ft	Infiltration constant for existing windows
i_{WIN}	Cfm/ft	Infiltration constant for proposed windows
l_W	ft	Linear feet of curtain wall

Morris County Vo-Tech
Exhibit D
ECM 4C Window Replacements
Window Replacement

* Inputs are in blue

Building	Window Area (ft^2)	U-Factor of Existing Window	U-Factor of Proposed Window	Infiltration of Existing Window (CFM / linear ft)	Infiltration of Proposed Window (CFM / linear ft)	Total Linear feet of Curtain Wall	EER of Cooling System (Average)
Building 1/2/3/5/6	181	1.20	0.29	0.20	0.10	0	11.0
Totals	**181**						

	Building 1/2/3/5/6		0
Window ft^2 Audited	181		
U of Existing Window	1.20		-
U of Proposed Window	0.29		-
Infiltration of Existing Windows	0.20		-
Infiltration of Proposed Windows	0.10		-
Total Linear Ft of Curtain Wall	-		-
EER of Cooling System (Average)	11.0		-
Existing Occupied Heating Setpoint	71.0		-
Existing Unoccup. Heating Setpoint	66.5		-
Existing Occupied Cooling Setpoint	73.0		-
Existing Unoccup. Cooling Setpoint	77.5		-
Boiler Efficiency	78.0%		0.0%
Safety Factor	0%		
Electrical Savings	443		-
Thermal Savings	174		

CALCULATIONS

BUILDING 1/2/3/5/6

Amb. Temp Bin °F	Avg Temp °F	01-08 Hours	09-16 Hours	17-24 Hours	Total Bin Hours	Occupied Hours	Unoccupied Hours	Window Square Feet	Existing Occupied Cooling Gain and Heating Loss	Existing Unoccupied Cooling Gain and Heating Loss	Proposed Occupied Cooling Gain and Heating Loss	Proposed Unoccupied Cooling Gain and Heating Loss	Cooling or Heating Savings	Infiltration savings	Total Heating or Cooling Savings	Safety Factor	kWh Saved	Input Therms Saved
COOLING									(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)	(MMBTU)			
100 to 105	102.5	-	-	-	-	-	-	181	-	-	-	-	-		-	0%	-	
95 to 100	97.5	-	5	-	5	5	-	181	0.0	-	0.0	-	0.0		0.0	0%	6	
90 to 95	92.5	-	34	2	36	35	1	181	0.2	0.0	0.0	0.0	0.1		0.1	0%	37	
85 to 90	87.5	1	100	27	128	117	11	181	0.4	0.0	0.1	0.0	0.3		0.3	0%	95	
80 to 85	82.5	17	328	92	437	392	45	181	0.9	0.1	0.2	0.0	0.7		0.7	0%	208	
75 to 80	77.5	106	270	200	576	435	141	181	0.5	-	0.1	-	0.4		0.4	0%	103	
70 to 75	72.5	226	185	248	659	425	234	181	-	-	-	-	-		-	0%	-	
65 to 70	67.5	245	207	283	735	476	259	181	-	-	-	-	-		-	0%	-	
60 to 65	62.5	348	154	240	742	435	308	181	-	-	-	-	-		-	0%	-	
HEATING														-				
55 to 60	57.5	113	129	118	360	245	115	181	0.7	0.1	0.2	0.1	0.6	-	0.6	0%		7
50 to 55	52.5	131	253	181	565	415	150	181	1.7	0.1	0.4	0.1	1.3	-	1.3	0%		17
45 to 50	47.5	117	180	134	431	308	123	181	1.6	0.1	0.4	0.1	1.2	-	1.2	0%		16
40 to 45	42.5	169	194	221	584	396	189	181	2.4	0.1	0.6	0.2	2.0	-	2.0	0%		26
35 to 40	37.5	215	186	247	648	421	227	181	3.1	0.1	0.7	0.3	2.5	-	2.5	0%		33
30 to 35	32.5	260	111	196	567	331	236	181	2.8	0.1	0.7	0.4	2.4	-	2.4	0%		31
25 to 30	27.5	144	59	119	322	187	135	181	1.8	0.1	0.4	0.3	1.5	-	1.5	0%		20
20 to 25	22.5	140	20	69	229	116	113	181	1.2	0.1	0.3	0.3	1.1	-	1.1	0%		14
15 to 20	17.5	66	21	16	103	56	47	181	0.6	0.0	0.2	0.1	0.6	-	0.6	0%		8
10 to 15	12.5	26	3	19	48	25	23	181	0.3	0.0	0.1	0.1	0.3	-	0.3	0%		4
5 to 10	7.5	3	-	1	4	2	2	181	0.0	0.0	0.0	0.0	0.0	-	0.0	0%		0
0 to 5	2.5	2	-	-	2	1	1	181	0.0	0.0	0.0	0.0	0.0	-	0.0	0%		0
-5 to 0	-2.5	-	-	-	-	-	-	181	-	-	-	-	-	-	-	0%		-
-10 to -5	-7.5	-	-	-	-	-	-	181	-	-	-	-	-	-	-	0%		-
-15 to -10	-12.5	-	-	-	-	-	-	181	-	-	-	-	-	-	-	0%		-
Total		2,329	2,439	2,413	7,181	4,821	2,361										443	174

Morris County Vo-Tech
Exhibit D
ECM 5A Computer Power Management
Computer Power Management

ECM DESCRIPTION

Install a centralized personal computer power management system to control computers and monitors.

DATA / ASSUMPTIONS

* Annual Savings for Student Computers	120	kWh/Yr
* Annual Savings for Administrative Computers	110	kWh/Yr

	On		Sleep Mode	
* CRT wattage (Average)	70	W	15	W
* LCD wattage	18	W	5	W

Annual Savings for Administrative Computers and Student Computers are based on previous logging results for computers with similar usage types

MEASUREMENT AND VERIFICATION

Option A - The engineering calculations are based on direct kW measurements of the existing and post software installation computers. All existing computers will be measured before the installation of the computer management software.

COMMISSIONING

Review installation documents for alignments and vibrations. Start up equipment and measure vibration through the load range along with motor kW. Verify that VFDs are capable of operating in full design range upon the control signal demand.

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

The safety factor for this ECM is taken at 0 due to some variability in schedule and load changes.

FORMULAE

$W_{TOTAL} = (W_{CPU} \cdot CPU_{\#}) + (W_{LCD} \cdot CRT_{\#})$

$W_{LCD} = (CRT_{\#} \cdot Monitor_{hrs\text{-}SLEEP} \cdot (W_{CRT\text{-}SLEEP} - W_{LCD\text{-}SLEEP}) \cdot Monitor_{\%OFF}) + (CRT_{\#} \cdot Monitor_{hrs\text{-}ON} \cdot (W_{CRT\text{-}ON} - W_{LCD\text{-}ON}))$

Variable	Units	Description
W_{TOTAL}	kWh	Total Electrical Savings associated with this measure
W_{CPU}	kWh	Electrical Savings associated with computer control
W_{LCD}	kWh	Electrical Savings associated with Monitor Replacement
$CPU_{\#}$	-	Numbers of Computers
$CRT_{\#}$	-	Numbers of CRTs

Morris County Vo-Tech
Exhibit D
ECM 5A Computer Power Management
Computer Power Management

W_{CRT-ON}	kWh	Wattage of CRT Monitor when ON
$W_{CRT-SLEEP}$	kWh	Wattage of CRT Monitor when in sleep mode
W_{LCD-ON}	kWh	Wattage of LCD Monitor when ON
$W_{LCD-SLEEP}$	kWh	Wattage of LCD Monitor when in sleep mode
$Monitor_{hrs-ON}$	hrs	Annual hours monitor is ON
$Monitor_{hrs-SLEEP}$	hrs	Annual hours monitor is in sleep mode
$Monitor_{\%OFF}$	%	Percentage that monitor is off during sleep mode hours

* Inputs are in blue

Building	# of Student Computers	# of Administrative Computers	# of CRTs to be Replaced
Building 1/2/3/5/6	248		
Building 4	72		
Totals	320	0	0

CALCULATIONS

	Building 1/2/3/5/6	Building 4
Number of Student Computers	248	72
Number of Administrative Computers	-	-
Total Number of Computers	248	72
Number of CRTs to be Replaced	-	-
Monitor On Run Hours	1,080	1,080
Monitor Sleep Mode Run Hours	3,240	3,240
Percentage of Monitors Turned off during Unoccupied Hours	65%	65%
kWh Savings (Monitor)	-	-
kWh Savings (Computers)	29,760	8,640
kWh Savings	29,760	8,640
Recovery Factor	90%	90%
kWh Savings	26,784	7,776

Morris County Vo-Tech
Exhibit D
ECM 6A Cogeneration CHP
Combined Heat and Power Plant

ECM DESCRIPTION

Installation of a Combined Heat and Power Plant (CHP). Recoverable heat from the CHP will be used to subsidize the heating requirements of the swimming pool.

DATA / ASSUMPTIONS

*Annual run hours are agreed upon by facility staff
*Annual waste dump hours are taken at 10% of run time
*CHP Natural Gas Consumption and Recoverable Heat Rate provided by the CHP Manufacturer.
* Parasitic load during normal operation **7%**

MEASUREMENT AND VERIFICATION

Option A (Electric) - The engineering calculations are based on direct kW measurements of the electrical output feed.
Option C (Thermal) - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Verify electrical and natural gas interconnects, as well as, electrical production by multimeter spot measurements. Verify proper exhaust ventilation.

A safety factor of 0.5 is conservative

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) =	**50%**
Safety Factor (Thermal) =	**0%**

FORMULAE

$W_{PRODUCTION} = (kW_{CHP} - KW_{PARA}) \cdot t_{CHP}$

$Q_{NET} = (Q_{CHP} - Q_{DISPLACED})$

$Q_{CHP} = Q_D$

$Q_{DISPLACED} = CHP_{NG\text{-}RATE} \cdot (t_{CHP} + t_{DUMP})$

$Q_D = CHP_{NG\text{-}USEABLE} \cdot (CHP_{RECOVERY} / CHP_{NG\text{-}RATE}) \cdot HEATEXG$

$CHP_{NG\text{-}USEABLE} = CHP_{NG\text{-}RATE} \cdot t_{CHP}$

Variable	Units	Description
$W_{PRODUCTION}$	kWh/yr	Annual Electrical Production of CHP
Q_{NET}	Therms/yr	Net Annual Natural Gas Consumption of CHP

Morris County Vo-Tech
Exhibit D
ECM 6A Cogeneration CHP
Combined Heat and Power Plant

$Q_{DISPLACED}$	Therms/yr	Avoided Boiler Natural Gas Consumption due to CHP Recoverable Heat
Q_D	Therms/yr	Annual CHP Recoverable Heat
kW_{CHP}	kW	CHP kW
kW_{PARA}	kW	CHP Parasitic Load
t_{CHP}	hrs	Annual CHP run time
t_{DUMP}	hrs	Annual CHP waste heat dump
Q_{CHP}	therms/yr	Annual Natural Gas Consumption of CHP
$CHP_{NG\text{-}USEABLE}$	therms/yr	Annual useable Natural Gas available for heating purposes
$CHP_{NG\text{-}RATE}$	therms/hr	Natural Gas Consumption rate for the CHP
$CHP_{RECOVERY}$	therms/hr	Recoverable heat from CHP
HEATEXG	%	Heat Exchanger Efficiency
n_{BOILER}	%	Boiler Efficiency

*Parastic Load, Natural Gas Consumption Rate, and Recoverable Heat Rate based off of Tecogen Literature. If using another manufacturer input fields manually

Building	CHP Plant Electric Output (kW)	Annual Run Hours of Plant	Heat Recovery Efficiency through Heat Exchanger	Parasitic Load* (kW)	Natural Gas Consumption Rate* (therm/hr)	Recoverable Heat Rate* (therm/hr)
Building 1/2/3/5/6	35.0	5,000	80%	2.5	3.7	2.3
				-	-	-
				-	-	-
Total	**35.0**			2.5		

	Building 1/2/3/5/6
CHP Plant Electric Output	35.0
Parasitic Load	2.5
Proposed Facility Electric Demand	32.6
Annual hours for CHP Plant	5,000
Annual Waste Heat Dump Hours	**500**
Annual CHP Plant Electric Output	162,750
Natural Gas Consumption Rate	3.7
Annual CHP Plant Natural Gas Consumption	18,350
Recoverable Heat Rate	2.3
Heat Recovery Efficiency through Heat Exchanger	80%
Recoverable CHP Heat Output	8,370
Boiler Efficiency	78.0%
Annual Displaced Natural Gas Consumption	10,731
kW Safety Factor	**50%**
Safety Factor	**0%**
kW Savings / Month	16.3
Annual kWh Production	162,750
Annual Net Thermal Consumption	(7,619)

Morris County Vo-Tech
Exhibit D
ECM 7A Permanent Load Reduction
Permanent Load Reduction

ECM DESCRIPTION

PJM Demand Response Program based on Shedable Load on Peak Demand Curtailment Day

DATA / ASSUMPTIONS

Demand Response Revenue	$ 15,000	/ MW
Permanent Load Reduction	$ 21,584	/ MW
Customer Share (Typically between 60-70%)	70%	

Year	All Other $/kW	PSEG $/kW
2017/2018	$25.00	$40.00
2018/2019	$40.00	$40.00
2019/2020	$22.00	$22.00
2020/2021	$22.00	$22.00
	$27.25	$31.00

*Demand Response Savings = Assumed between 1 - 4% Annual Electrical Load
*Assume 2% of Total District Load as Shedable
*Savings is not Guaranteed any savings from program will be considered operational savings only

MEASUREMENT AND VERIFICATION

None - Operational Savings

COMMISSIONING

N/A

RECOVERY/SAFETY FACTOR

N/A

FORMULAE

$$\$_{savings} = kWh_{ADJ} \cdot Cust_{\%} \cdot DM_{\%}$$

Variable	Units	Description
$\$_{savings}$	Dollars	Dollar Savings from Demand Response
$DM_{\%}$	%	Demand Response Savings as a percentage of electric baseline
$Cust_{\%}$	%	Customer Percentage of Savings
kWh_{BASE}	kWh	Adjusted Boiler Fuel Usage

* Inputs are in blue

Morris County Vo-Tech
Exhibit D
ECM 7A Permanent Load Reduction
Permanent Load Reduction

Building	Demand Response/ Permanent Load Reduction Participation (Y/N)
Building 1/2/3/5/6	Y
Building 4	Y

CALCULATIONS

	Building 1/2/3/5/6	Building 4
Demand Response Participation	Y	Y
Average Monthly kW	349	200
Permanent Load Shed Reduction (kW)	66	37
Sheddable Load (kW)		
Percentage of Baseline Demand	19.0%	18.5%
Demand Response $ / MW	$ 15,000	$ 15,000
Permanent Load Shed Reduction $ / MW	$ 21,584	$ 21,584
Demand Hours / Year	-	-
Cost to Run Generator / hr	$ -	$ -
Cost to Run Generator / yr	$ -	$ -
Safety Factor	0%	0%
DR and PLR Savings	$ 1,432	$ 798
Net Demand Response Savings to Customer	$ 1,002	$ 558

Morris County Vo-Tech
Exhibit D
ECM 8A Solar PPA
Solar PPA Photovoltaic System

ECM DESCRIPTION

Installation of a photovoltaic array utilizing Solar Power Purchase Agreement (PPA) - reducing grid electricity with a reduction of greenhouse gas emissions.

DATA / ASSUMPTIONS

PPA Cost per kWH	**$0.045**
*1-Axis Tracking System Collection Improvement:	**18.6%**

*Emperical studies show an that annual output increases 18.6% with use of one-axis sun tracking
**Assume two weeks of downtime for PV maintenance

Solar radiation at ground level was obtained using the data collected by the National Renewable Energy Laboratory (NREL) via the software Pvwatts.
Proposed technology is only able to convert 77% of the direct current produced at the panel to a usable alternative current for building consumption

MEASUREMENT AND VERIFICATION

N/A - Utilize baseline kWh consumption to determine kWh produced. Measure and provide a report of the kWh generated.

COMMISSIONING

Test installed system - measuring the output and verify with calculations for weather conditions. Verify all electrical connections and tie-ins to the grid and the building power.

RECOVERY/SAFETY FACTOR

Safety Factor (Electrical) = **0%**

FORMULAE

$$W_{PV} = \sum_{Jan}^{Dec} (Q_{RAD} \cdot A_{PV} \cdot t_{MONTH}) \cdot t_{\%}$$

Variable	Units	Description
W_{PV}	kWh	Electrical energy produced by PV array
$\sum_{Jan}^{Dec}$	-	Summation of months
Q_{RAD}	$kWh/m^2/day$	Solar radiation (averaged by month) capable of being collected with the proposed PV technology
A_{PV}	ft^2	Area of proposed system
t_{MONTH}	Days	Days in the month
$t_{\%}$	%	Percentage of operational time

Morris County Vo-Tech
Exhibit D
ECM 8A Solar PPA
Solar PPA Photovoltaic System

*Inputs are blue

Building	DC Rating of System	Install 1-Axis Tracking System (Y/N)
Building 1/2/3/5/6	475.1	N
Building 4	0.0	N
Totals	**475.1**	

Cell ID	Newark		
State	New Jersey		
Latitude	40.7 N		
Longitude	74.17 W		
Month	Days in Month	**Solar Radiation (kWh/day)	Solar Radiation per 1-kW (kWh)
Jan	31	2.39	74.1
Feb	28	3.17	88.8
Mar	31	4.07	126.2
Apr	30	4.83	144.9
May	31	5.7	176.7
Jun	30	5.94	178.2
Jul	31	5.77	178.9
Aug	31	5.38	166.8
Sep	30	4.65	139.5
Oct	31	3.61	111.9
Nov	30	2.35	70.5
Dec	31	2.01	62.3
Total		4.16	**1,518.7**

CALCULATIONS

	Building 1/2/3/5/6
DC Rating of System	475.1
Safety Factor	4%
Maximum DC Rating	458.0
Install 1-Axis Tracking System	N
**Annual Operational Hours	8,424
DC to AC Safety Factor	0.83

Morris County Vo-Tech
Exhibit D
ECM 8A Solar PPA
Solar PPA Photovoltaic System

*Efficiency gain with 1-Axis Tracking	0.0%
Total kWh AC per year Generated	555,059.25
Solar Factor	64%
kWh Savings	355,210

Morris County Vo-Tech
Exhibit D
ECM 9A Transformers
Transformer Replacement

ECM DESCRIPTION

Replace dry transformers with new custom designed high efficiency transformers. New transformers will save electricity and avoid the future replacements due to failure.

DATA / ASSUMPTIONS
*Input Measured kW losses (If kW losses are not none calculation will calculate efficiency using past results)
* Existing loads were obtained by data logging
* Existing efficiencies were obtained by data logging or manufacturer specifications

MEASUREMENT AND VERIFICATION

Option A - Direct kW and savings measurements before and after installation conducted. A report is generated showing the reduction in kW

COMMISSIONING

Test all transformers after installation

RECOVERY/SAFETY FACTOR

Safety Factor (Electric) = 0%

Recovery factor is set at 10% due to unknown flucuations in transformer loads

FORMULAE

$W_{SAVINGS} = \varepsilon_T - \varepsilon_T$

$\varepsilon_T = \varepsilon_{OCC} \cdot t_{OCC} + \varepsilon_{UNOCC} \cdot t_{UNOCC}$
$\varepsilon_T = \varepsilon_{OCC} \cdot t_{OCC} + \varepsilon_{UNOCC} \cdot t_{UNOCC}$

$\varepsilon_{OCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{OCC}] - (KVA \cdot Lf_{OCC})$
$\varepsilon_{OCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{OCC}] - (KVA \cdot Lf_{OCC})$

$\varepsilon_{UNOCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{UNOCC}] - (KVA \cdot Lf_{OCC})$
$\varepsilon_{UNOCC} = [(Lf_{OCC} \cdot KVA) / \eta_L^{UNOCC}] - (KVA \cdot Lf_{OCC})$

$\eta_L^{OCC} = Lf_{OCC} \cdot kVA \cdot \eta_T$
$\eta_L^{OCC} = Lf_{OCC} \cdot kVA \cdot \eta_T$

$\eta_L^{UNOCC} = Lf_{UNOCC} \cdot kVA \cdot \eta_T$
$\eta_L^{UNOCC} = Lf_{UNOCC} \cdot kVA \cdot \eta_T$

Variable	Units	Description
$W_{savings}$	kWh	Electrical Savings
ε_T	kW	Existing annual transformer losses
ε_T	kW	Proposed annual transformer losses
t_{OCC}	Hrs	Existing Run Hours
t_{UNOCC}	Hrs	Proposed Run Hours
ε_{OCC}	kW	Existing transformer losses during occupied hours
ε_{OCC}	kW	Proposed transformer losses during occupied hours
ε_{UNOCC}	kW	Existing transformer losses during unoccupied hours
ε_{UNOCC}	kW	Proposed transformer losses during unoccupied hours
kVA	kVA	kVA of existing transformer
Lf_{OCC}	-	Load Factor of transformer during occupied hours
Lf_{UNOCC}	-	Load Factor of transformer during unoccupied hours
η_L^{OCC}	%	Existing efficiency of transformer during occupied hours
η_L^{OCC}	%	Proposed efficiency of transformer during occupied hours
η_L^{UNOCC}	%	Existing efficiency of transformer during unoccupied hours
η_L^{UNOCC}	%	Proposed efficiency of transformer during unoccupied hours
η_T	%	Existing weighted efficiency of transformer at various loads
η_T	%	Proposed weighted efficiency of transformer at various loads

* Inputs are in blue

Morris County Vo-Tech
Exhibit D
ECM 9A Transformers
Transformer Replacement

Calculation is automatic. If Efficiencies are known override automatically generated efficiencies in Columns G through M when necessary

							EXISTING						PROPOSED			
Building	Replace	Tag Number	Location ID	Transformer Designation	Qty	kVA	% Load During Occupied Hours	% Load During Unoccupied Hours	Baseline kW Losses (Normal Operation)	Baseline kW Losses (Outside Op. hrs)	Efficiency at Occupied Loads	Efficiency at Unoccupied Loads	New Transformer kW Losses (Normal Operation)	New Transformer kW Losses (Outside Op. hrs)	Efficiency Occupied Loads	Efficiency Unoccupied Loads
Building 4	y	T-1	Electrical Room	9T23L8079	1.00	500.0	5.7%	2.0%	3.297	3.272	94.48%	91.57%	0.584	0.561	98.45%	98.12%
Building 4	y	T-2	Room 417 Closet	9T23Q3572	1.00	30.0	10.1%	5.0%	0.453	0.446	89.89%	85.78%	0.070	0.060	96.90%	95.90%
Building 4	n	T-3	Autobody 2	0	1.00	75.0	8.3%	3.0%					0.128	0.113		
Building 4	n	T-4	Autobody 2	0	1.00	112.5	10.2%	5.0%	-	-						
Totals					**4**	**718**										

CALCULATIONS

	Building 4	Building 4
Replace Transformer	y	y
kVa	500.0	30.0
Quantity	1	1
% Load at Occupied Hours	6%	10%
% Load at Unoccupied Hours	2%	5%
Estimated Efficiences		
Existing Efficiency at Occupied Loads	94.5%	89.9%
Existing Efficiency at Unoccupied Loads	91.6%	85.8%
Proposed Efficiency at Occupied Loads	98.5%	96.9%
Proposed Efficiency at Unoccupied Loads	98.1%	95.9%
Measured Baseline Losses		
Existing Losses at Occupied Loads	3.297	0.453
Existing Losses at Unoccupied Loads	3.272	0.446
Proposed Losses at Occupied Loads	0.584	0.070
Proposed Losses at Unoccupied Loads	0.561	0.060
Measured kW Losses		
Existing kW Losses Occupied Hours	2.713	0.383
Existing kW Losses Unoccupied Hours	2.711	0.386
Estimated kW Losses based on Efficiences		
Existing kW Losses Occupied Hours Calculated	1.665	0.3410
Existing kW Losses Unoccupied Hours Calculated	2.623	0.5023
Occupancy		
Occupied Hours per Day	**16**	**16**
Occupied Days per Year	**200**	**200**
Estimated kWh Losses based on Efficiences		
Existing Annual kWh Losses	19,914	3,884
Proposed kW and kWh Losses based on Efficiences		
Proposed kW Losses Occupied Hours	0.4487	0.0969
Proposed kW Losses Unoccupied Hours	0.1916	0.0641
Proposed Annual kWh Losses	2,501	667
Safety Factor	**0%**	**0%**
Total kW and kWh Savings		
kW Savings	2.713	0.383
kWh Savings	23,755	3,372

Morris County Vo-Tech
Exhibit D
ECM 10A Energy Education
Energy Education

ECM DESCRIPTION

Energy Education Services provides student vocation training, controls lab course, green boot camp and/or energy optimization intern program "Project Tag Along".

DATA / ASSUMPTIONS

Energy Services Savings **0.0%**

Program will allow students the opportunity to safely participate in the development of the Energy Savings Plan. Savings are based on increased energy awareness of building occupants, but not quantified.

MEASUREMENT AND VERIFICATION

N/A

COMMISSIONING

N/A

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) = **0%**

FORMULAE

$Q_{savings} = Fuel_{ADJ} \cdot Attune_{\%}$

Variable	Units	Description
$Q_{savings}$	Therms	Thermal Savings
$Attune_{\%}$	**%**	Percentage reduction of thermal consumption due to Attune Advisory Services
$Fuel_{ADJ}$	Therms	Adjusted Boiler Fuel Usage

* Inputs are in blue

Building	Implement Energy Education
Building 1/2/3/5/6	Y
Building 4	Y

Morris County Vo-Tech
Exhibit D
ECM 10A Energy Education
Energy Education

CALCULATIONS

	Building 1/2/3/5/6	Building 4
Energy Education Services	Y	Y
Annual Boiler Fuel Use	84,240	43,094
Adjusted Boiler Usage	70,815	37,198
Energy Education Savings	0.0%	0.0%
Thermal Savings	-	-
Safety Factor	**0%**	**0%**
Thermal Savings	-	-

Morris County Vo-Tech
Exhibit D
ECM 11A Water Conservation
Water Conservation

ECM DESCRIPTION

Reduce water consumption by replacing older less-efficient toilets, urinals, faucets, sinks and showerheads with more water efficient fixtures.

DATA / ASSUMPTIONS

* Existing flow rates were determined by flushometers during walk-throughs
*Proposed flow rates were determined by manufacturer data

MEASUREMENT AND VERIFICATION

Option C (Thermal)- Savings Calculations are based on regression analysis of utility billing meter data
Option C (Water) - Savings Calculations are based on regression analysis of utility billing meter data

COMMISSIONING

Ensure installation by testing for leaks and proper functionality.

RECOVERY/SAFETY FACTOR

Safety Factor (Thermal) =	10%
Safety Factor (Water) =	10%

Recovery factor taken at 10% due to the variability of fixture usage

FORMULAE

$$Q_{SAVINGS} = [(h_{SAVINGS} \cdot 8.34) \cdot (1000 / 100000)] / n_{BOILER}$$

$$h_{SAVINGS} = (h_{Toilet} - h_{Toilet}) + (h_{Urinal} - h_{Urinal}) + (h_{Sink} - h_{Sink}) + (h_{Shower} - h_{Shower})$$

$$h_{Toilet} = (Toilet_{RATE} \cdot Toilet_{USAGE} \cdot Occ_{\%}) / 1{,}000$$
$$h_{Toilet} = (Toilet_{RATE} \cdot Toilet_{USAGE} \cdot Occ_{\%}) / 1{,}000$$

$$h_{Urinal} = (Urinal_{RATE} \cdot Urinal_{USAGE} \cdot Occ_{\%}) / 1{,}000$$
$$h_{Urinal} = (Urinal_{RATE} \cdot Urinal_{USAGE} \cdot Occ_{\%}) / 1{,}000$$

$$h_{Sink} = (Sink_{RATE} \cdot Sink_{USAGE} \cdot Occ_{\%}) / 1{,}000$$
$$h_{Sink} = (Sink_{RATE} \cdot Sink_{USAGE} \cdot Occ_{\%}) / 1{,}000$$

$$h_{Shower} = (Shower_{RATE} \cdot Shower_{USAGE} \cdot Occ_{\%}) / 1{,}000$$
$$h_{Shower} = (Shower_{RATE} \cdot Shower_{USAGE} \cdot Occ_{\%}) / 1{,}000$$

Variable	Units	Description
$Q_{SAVINGS}$	Therms	Annual Thermal Savings

Morris County Vo-Tech
Exhibit D
ECM 11A Water Conservation
Water Conservation

$h_{SAVINGS}$	kGal	Annual Water Savings
η_{BOILER}	%	Efficiency of Boiler
T_{SINK}	°F	Temperature of Sink Water
T_{SHOWER}	°F	Temperature of Shower Water
T_{CITY}	°F	Temperature of incoming city water
h_{TOILET}	kGal	Existing Toilet Water Usage
h_{TOILET}	kGal	Proposed Toilet Water Usage
h_{Urinal}	kGal	Existing Urinal Water Usage
h_{Urinal}	kGal	Proposed Urinal Water Usage
h_{Sink}	kGal	Existing Sink Water Usage
h_{Sink}	kGal	Proposed Sink Water Usage
h_{Shower}	kGal	Existing Shower Water Usage
h_{Shower}	kGal	Proposed Shower Water Usage
Occ_{DAYS}	-	Equivalent Days of occupied use
$Occ_{\%}$	%	Percentage of occupants that occupy the building daily
Ppl	-	Number of building occupants
$Ur_{\%}$	%	Urinal Usage Factor
$Toilet_{USAGE}$	-	Toilet Usage per day per occupant
$Urinal_{USAGE}$		Urinal Usage per day per occupant
$Sink_{USAGE}$		Sink Usage per day per occupant
$Shower_{USAGE}$		Shower Usage per day per occupant
$Toilet_{RATE}$	Gallons	Existing Gallons per Usage
$Toilet_{RATE}$	Gallons	Proposed Gallons per Usage
$Urinal_{RATE}$	Gallons	Existing Gallons per Usage
$Urinal_{RATE}$	Gallons	Proposed Gallons per Usage
$Sink_{RATE}$	Gallons	Existing Gallons per Usage
$Sink_{RATE}$	Gallons	Proposed Gallons per Usage
$Shower_{RATE}$	Gallons	Existing Gallons per Usage
$Shower_{RATE}$	Gallons	Proposed Gallons per Usage

* Inputs are in blue
*Checks against baseline are in purple

Subcontractor Calculations N * If Yes - Please Refer to tab 'Sub Water Conservation' for details

Building	Water Conservation	Daily Occupants	Occupied Days
Building 1/2/3/5/6	**Y**	**1,540**	**180**
Totals		**1,540**	**180**

CALCULATIONS

Morris County Vo-Tech
Exhibit D
ECM 11A Water Conservation
Water Conservation

	Building 1/2/3/5/6
Water Conservation	Y
Item	
Daily Occupants	1,540
Area of Occupied Facilities	125,715
Occupancy Factor	85%
Occupied Days	180
Occupant Days	235,620
Toilet Consumption	
Toilet Usage Rate	1.04
Existing Toilet Flow Rate	2.88
Existing Annual Toilet Flow	706
Proposed Toilet Flow Rate	1.28
Proposed Annual Toilet Flow	314
Urinal Consumption	
Urinal Usage Rate	0.98
Urinal Usage Factor	50%
Existing Urinal Flow Rate	1.38
Existing Annual Urinal Flow	159
Proposed Urinal Flow Rate	0.125
Proposed Annual Urinal Flow	14
Lavatory/Sink Consumption	
Sink Usage Factor	85%
Existing Sink Flow Rate	1.72
Existing Annual Sink Flow	344
Proposed Sink Flow Rate	0.50
Proposed Annual Sink Flow	100
Shower Consumption	
Shower Usage Factor	-
Existing Shower Flow Rate	2.5
Existing Annual Shower Flow	-
Proposed Shower Flow Rate	1.5
Proposed Annual Shower Flow	-
Kitchen Consumption	
% Persons Eat Breakfast	10%
% Persons Eat Lunch	75%
% Persons Eat Dinner	0%
Breakfast Consumption	0.650
Lunch Consumption	0.950
Dinner Consumption	1.000

Morris County Vo-Tech
Exhibit D
ECM 11A Water Conservation
Water Conservation

Total Meal Consumption	183.19
Miscellaneous	
Drinking Water	0.06
Cleaning	**0.55**
Campus Area	0
Garden Area	0.15
Total Irrigation	0
Vehicle Washing	0
Lab Equipment testing	0
Annual Cooling Load to tower	
Cooling Tower M/U	-
Boiler Make-up	-
Total Misc. uses	167
Laundry	
Load person	0
% Occupant Laundry Done	0
Gal/Load	0
Annual Use	-
Leaks	
% Total Water Use	1%
Total Loss	15.28
% of Loss Repaired During Retrofit	10%
Retrofit Water Consumption	14
Baseline Water Consumption	1,528
Calculated Existing Water Usage	1,575
Water Usage Accounted for (Must be 70% to 100%)	**97.0%**
Calculated Proposed Water Usage	789
Water Savings	786
Thermal Savings	
City Water Temperature	60
Sink Water temperature	120
Shower Water Temperature	110
Boiler Efficiency	78.0%
Thermal Savings	1,221
Actual Thermal Savings	1,566
Safety Factor Water	**10%**
Safety Factor Thermal	**10%**
Water Savings	707
Thermal Savings	1,409

APPENDIX 3 CUTSHEETS

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Building Sealant Recommendations and Surface Preparation Guide for Weatherseal Applications

Weatherseal

Dow Corning has a full line of high-performance primers for sealants. Primers are used to enhance adhesion.

	Dow Corning® 756 SMS Building Sealant	*Dow Corning*® 790 Silicone Building Sealant[1]	*Dow Corning*® 791 Silicone Weatherproofing Sealant	*Dow Corning*® 795 Silicone Building Sealant
Substrate	**Surface Prep**			
Concrete and Masonry				
Brick	Limited Data/Field Test	No Primer	1200 OS/Primer P	Primer P
Concrete	Field Test	No Primer	1200 OS/Primer P	Primer P
Mortar	Primer P	No Primer	Primer P	Primer P
EIFS[2]				
All Manufacturers[3]	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Stone				
Granite	No Primer	No Primer	Limited Data/Field Test	1200 OS/Primer P
Travertine	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Marble[4]	1200 OS/Primer P	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Limestone[8]	1200 OS/Primer P	Limited Data/Field Test	Limited Data/Field Test	Primer P
(Natural Stone) Sandstone[9]	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Primer P
Paints				
Acrylic Latex	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Duracron	No Primer	Limited Data/Field Test	No Primer	1200 OS/Primer P
Polyester Powder Coating[7]	Limited Data/Field Test	1200 OS	No Primer	No Primer
Polyurethane	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Polyvinyl Chloride (PVC)	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Fluoropolymer				
Kynar®	No Primer	Limited Data/Field Test	No Primer	Primer-C OS
Duranar®	No Primer	Limited Data/Field Test	No Primer	Primer-C OS
Duranar Sunstorm®	Limited Data/Field Test	Limited Data/Field Test	No Primer	Primer-C OS
Fluropon®	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Primer-C OS
Metals				
Aluminum – Chromate Conversion, Alodine®	No Primer	Limited Data/Field Test	No Primer	No Primer
Aluminum – Mill Finish	No Primer	1200 OS	1200 OS	1200 OS
Aluminum – Anodized	No Primer	1200 OS	No Primer	No Primer
Copper	Do Not Use	Do Not Use	No Primer	No Primer
Lead	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test

	Dow Corning® 756 SMS Building Sealant	*Dow Corning*® 790 Silicone Building Sealant[1]	*Dow Corning*® 791 Silicone Weatherproofing Sealant	*Dow Corning*® 795 Silicone Building Sealant
Substrate	**Surface Prep**			
Glass[6]				
Coated Glass	No Primer	1200 OS	No Primer	No Primer
Clear Glass	No Primer	No Primer	No Primer	No Primer
Steel				
Red Lead Primer	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Weathered	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Stainless	Limited Data/Field Test	Limited Data/Field Test	1200 OS	1200 OS
Galvanized	No Primer	1200 OS	No Primer	1200 OS/Primer P
Cold Rolled	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test	Limited Data/Field Test
Plastics				
PVC	Limited Data/Field Test	Limited Data/Field Test	1200 OS/Primer P	No Primer
Acrylic	Limited Data/Field Test	Do Not Use	Limited Data/Field Test	Limited Data/Field Test
Polycarbonate	Do Not Use	Do Not Use	Limited Data/Field Test	Limited Data/Field Test

Key: 1200 OS: *Dow Corning*® 1200 OS Primer; PC: *Dow Corning*® Primer-C OS; PP: *Dow Corning*® Primer P; NA: Not applicable
Dow Corning must test all materials for adhesion in structural applications.
Field adhesion tests must be performed at the jobsite to verify sealant adhesion.

[1] When using a primer with *Dow Corning*® 790 Silicone Building Sealant, apply the primer before installing backer rod and allow the primer to dry. Cold weather and porous surfaces require additional drying time.
[2] Do not apply sealant to EIFS finish coat unless approved by EIFS manufacturer.
[3] Cleaning procedures for EIFS systems should be followed.
[4] The extremely porous nature of some marble, particularly white marble, can contribute to the potential for fluid migration into this substrate. Contact a Dow Corning Specialist when working with marble.
[5] Laminated glass with polyvinyl buyvol (PVB) interlayer may delaminate up to 1/4” at the edges when in contact with a sealant.
[6] Do not use *Dow Corning*® 790 Silicone Building Sealant on copper sputter coated glass.
[7] See *Organic Solvent Usage* in the *Dow Corning Americas Technical Manual* (62-1112) for comment.
[8] Some limestone and other porous stone substrates contain iron and other impurities that can interact with *Dow Corning*® 756 SMS Building Sealant, causing discoloration of the sealant and/or substrate. Prior to use, *Dow Corning*® 756 SMS Building Sealant should be tested for compatibility with these substrates using water immersion.

This surface preparation guide is intended to aid in proper selection of surface preparation techniques and primers, if necessary, to gain adhesion that meets Dow Corning’s requirements. The suggestions in this guide are not blanket-approval recommendations; Dow Corning requires all surface prep recommendations in this guide be verified by field or shop adhesion testing and documented prior to starting the project for each substrate/sealant combination. Failure to verify and document adhesion results may result in adhesion loss that is not covered by the Dow Corning Warranty. Recommendations in this guide have been shown to be the best overall recommendations but do not cover every substrate for each material type or finish listed in this guide. Additionally, substrate manufacturers should be contacted to obtain recommendations for proper cleaning solvents for use with their materials. The entire *Weatherproofing* section of the *Dow Corning Americas Technical Manual*, Form No. 62-1112, should be read and understood before proceeding with the evaluations. The following sections within the manual must be followed to verify and document adhesion:

- *Substrate Cleaning Procedure*
- *“Two Cloth” Cleaning Method*
- *Primer Application Procedure*
- *Field Adhesion Testing Procedure*
- *Field Adhesion Hand Pull Test Criteria*
- *Field/Shop Adhesion Log and Sealant Quality Control Logs*

Structural

All structural applications must be tested by the Dow Corning test lab.

	Dow Corning® 795 Silicone Building Sealant	*Dow Corning*® 983 Structural Glazing Sealant	*Dow Corning*® 995 Silicone Structural Sealant	*Dow Corning*® 121 Structural Glazing Sealant
Substrate	**Surface Prep**			
Paints				
Acrylic Latex	Limited Data/Lab Test	Limited Data/Lab Test	Limited Data/Lab Test	Limited Data/Lab Test
Duracron	Primer-C OS	Primer-C OS	Primer-C OS	Primer-C OS
Polyester Powder Coating[1]	Primer-C OS, 1200 OS	Primer-C OS, 1200 OS	No Primer	Primer-C OS
Fluoropolymer				
Kynar®	Primer-C OS	Primer-C OS, 1200 OS	No Primer	Primer-C OS
Duranar®	Primer-C OS	Primer-C OS	Primer-C OS	Primer-C OS
Duranar Sunstorm®	Primer-C OS	Primer-C OS	Primer-C OS	Limited Data/Lab Test
Fluropon®	Primer-C OS	Primer-C OS	Primer-C OS	Limited Data/Lab Test
Metals				
Aluminum – Chromate Conversion, Alodine®	No Primer, 1200 OS	No Primer, 1200 OS	1200 OS	1200 OS
Aluminum – Anodized	No Primer	No Primer, 1200 OS	1200 OS	1200 OS
Glass – Surface to be Glazed to				
Clear	No Primer	No Primer	No Primer	No Primer
Float	No Primer	No Primer	No Primer	No Primer
Laminated[2]	No Primer	No Primer	No Primer	No Primer
Plate	No Primer	No Primer	No Primer	No Primer
Tinted	No Primer	No Primer	No Primer	No Primer
Ceramic Frit Coating	No Primer	No Primer	No Primer	No Primer
Reflective Glass	No Primer	No Primer	No Primer	No Primer
Low E High (T) Glass	No Primer	No Primer	No Primer	No Primer

Key: 1200 OS: *Dow Corning*® 1200 OS Primer; PC: *Dow Corning*® Primer-C OS; PP: *Dow Corning*® Primer P; NA: Not applicable
Dow Corning must test all materials for adhesion in structural applications.
Field adhesion tests must be performed at the shop or jobsite to verify sealant adhesion.

[1] See *Organic Solvent Usage* in the *Dow Corning Americas Technical Manual* (62-1112) for comment.
[2] Laminated glass with polyvinyl buyvol (PVB) interlayer may delaminate up to 1/4” at the edges when in contact with a sealant.

This surface preparation guide is intended to aid in proper selection of surface preparation techniques and primers, if necessary, to gain adhesion that meets Dow Corning’s requirements. The suggestions in this guide are not blanket-approval recommendations; Dow Corning requires all surface prep recommendations in this guide be verified by field or shop adhesion testing and documented prior to starting the project for each substrate/sealant combination. Failure to verify and document adhesion results may result in adhesion loss that is not covered by the Dow Corning Warranty. Recommendations in this guide have been shown to be the best overall recommendations but do not cover every substrate for each material type or finish listed in this guide. Additionally, substrate manufacturers should be contacted to obtain recommendations for proper cleaning solvents for use with their materials. The entire *Weatherproofing* section of the *Dow Corning Americas Technical Manual*, Form No. 62-1112, should be read and understood before proceeding with the evaluations. The following sections within the manual must be followed to verify and document adhesion:

- *Substrate Cleaning Procedure*
- *“Two Cloth” Cleaning Method*
- *Primer Application Procedure*

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The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in substitution for customer's tests to ensure that our products are safe, effective and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

Dow Corning's sole warranty is that our products will meet the sales specifications in effect at the time of shipment.

Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted.

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CP35D1

YANMAR 35 kW CHP System Specifications				CP35D1			
Model				**CP35D1-TNUG**	**CP35D1Z-TNUG**	**CP35D1-TNUW**	**CP35D1Z-TNUW**
Configuration			-	Standard	Standard with Blackout Start	Radiator-Free	Radiator-Free with Blackout Start
Power Output	**Rated output**		**kW**	35	35	35	35
	Voltage, Frequency		**V, Hz**	208, 60	208, 60	208, 60	208, 60
	Phase and Wire		-	3 phase, 3 wire	3 phase, 3 wire *3	3 phase, 3 wire	3 phase, 3 wire *3
	Modulation		0.5 to 35 kW with optional CT/Transducer kit *1				
Fuel	**Gas Type**		-	Natural gas	Natural gas	Natural gas	Natural gas
	Pressure	**Standard**	**in WC (kPa)**	9.0 (2.25)	9.0 (2.25)	9.0 (2.25)	9.0 (2.25)
		Working Range	**in WC (kPa)**	8.0-10.0 (2.0-2.5)	8.0-10.0 (2.0-2.5)	8.0-10.0 (2.0-2.5)	8.0-10.0 (2.0-2.5)
	Consumption (LHV)		**BTU (kW)**	367,487 (107.7)	367,487 (107.7)	367,487 (107.7)	367,487 (107.7)
			THERMS/HR	3.67	3.67	3.67	3.67
	Consumption (HHV)*2		**BTU (kW)**	407,114 (119.3)	407,114 (119.3)	407,114 (119.3)	407,114 (119.3)
			THERMS/HR	4.07	4.07	4.07	4.07
	Conusmption (Input kW/kWe)		**kW**	3.08	3.08	3.08	3.08
Heat Output (Heat Recovery)	**Rated recovered heat**		**BTU/HR (kW)**	204,040 (59.8)	204,040 (59.8)	204,040 (59.8)	204,040 (59.8)
	Rated Temp.	**INLET**	**°F (°C)**	167 (75)	167 (75)	167 (75)	167 (75)
		OUTLET	**°F (°C)**	176 (80) MAX 190.4 (88)	176 (80) MAX 190.4 (88)	176 (80) MAX 190.4 (88)	176 (80) MAX 190.4 (88)
	Rated Hot water Flow		**GPM (L/min)**	46.5 (176)	46.5 (176)	46.5 (176)	46.5 (176)
Input Power Supply	**Voltage, Frequency**		**V, Hz**	208, 60	208, 60	208, 60	208, 60
	Staring Current		**A**	46	46	46	46
	Rated power consumption	**Radiator fan stop**	**kW**	0.72	0.75	NA	NA
		Radiator fan run	**kW**	0.97	1.00	NA	NA
Gross Efficiency	**Overall efficiency (LHV)**		**%**	88.0	88.0	88.0	88.0
	Generating efficiency (LHV)		**%**	32.5	32.5	32.5	32.5
	Exhausst heat recovery rate (LHV)		**%**	55.5	55.5	55.5	55.5
Operation Noise	**Radiator fan stop**		**dB(A)**	62	62	NA	NA
	Radiator fan run			64	64	NA	NA
Dimensions	**Width**		**in (mm)**	78.7 (2000)	78.7 (2000)	78.7 (2000)	78.7 (2000)
	Depth		**in (mm)**	31.5 (800)	31.5 (800)	31.5 (800)	31.5 (800)
	Height		**in (mm)**	78.2 (1987)	78.2 (1987)	78.2 (1987)	78.2 (1987)
	Weight		**lbs (kg)**	3,064 (1390)	3,284 (1430)	3,064 (1390)	3,284 (1430)
Maintenance interval			**hr**	7500	7500	7500	7500
Standard Warranty			-	2 Years; 15,000 Hours*	2 Years; 15,000 Hours*	2 Years; 15,000 Hours*	2 Years; 15,000 Hours*
YES Product Protection			-	10 Years; 30,000 Hours*	10 Years; 30,000 Hours*	10 Years; 30,000 Hours*	10 Years; 30,000 Hours*
			-	10 years; 60,000 Hours*	10 years; 60,000 Hours*	10 years; 60,000 Hours*	10 years; 60,000 Hours*
Emissions & Certifications				EPA Certified UL2200 Certified CSAC22.2 No 14 Certified CSAC22.2 No 100 Certified UL1741/IEEE1547 Certified			

*1 The minimum modulation amount is dependent on the CT and Transducer specifications
*2 Natural gas calculations for fuel consumption are based on converting LHV to HHV: LHV=983 BTU/scf,HHV= 1,089 BTU/scf
*3 Transformer necessary for 120V AC power requirements.
* Whichever comes first

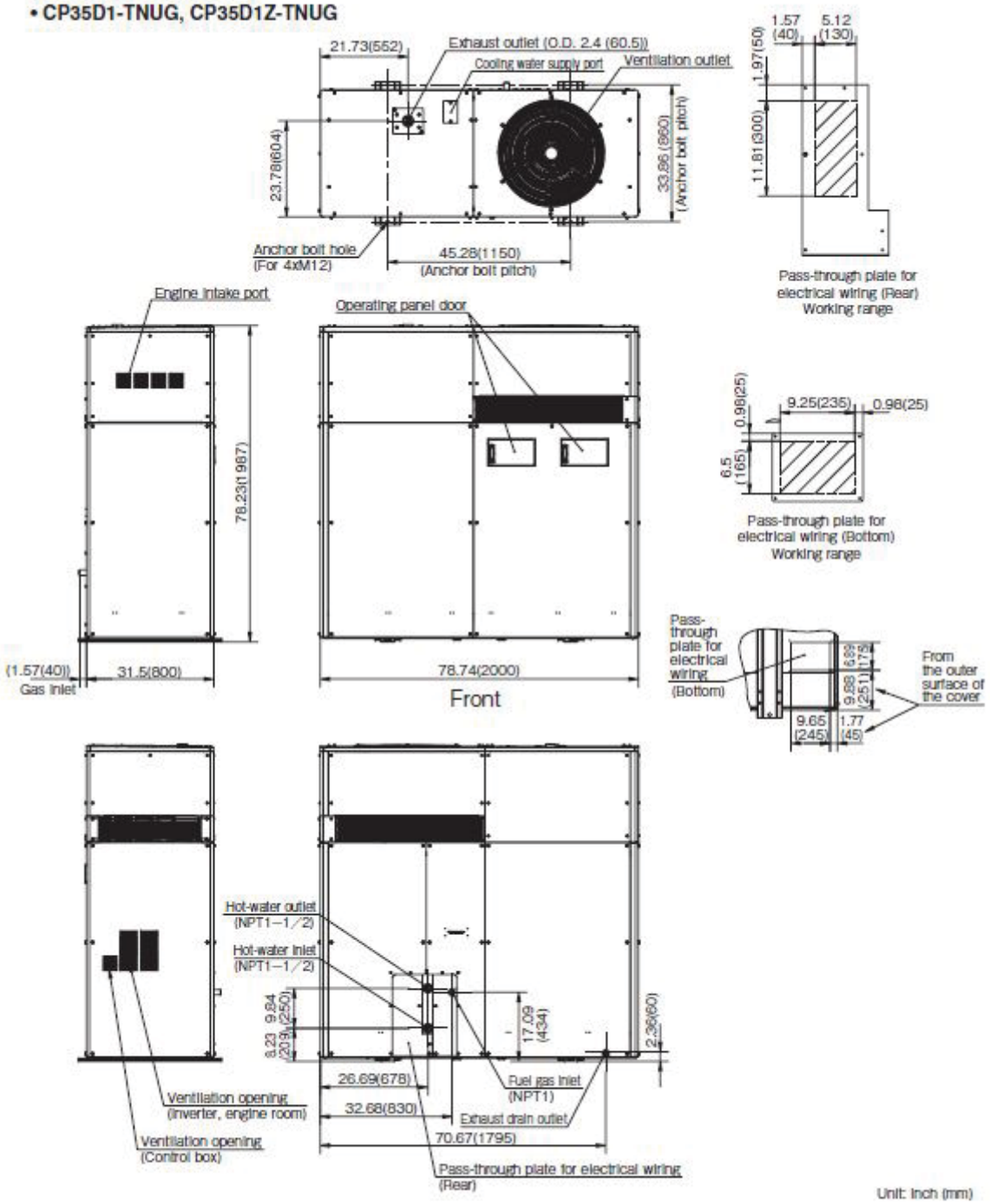
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CP35D1

[Standard specification]

• CP35D1-TNUG, CP35D1Z-TNUG



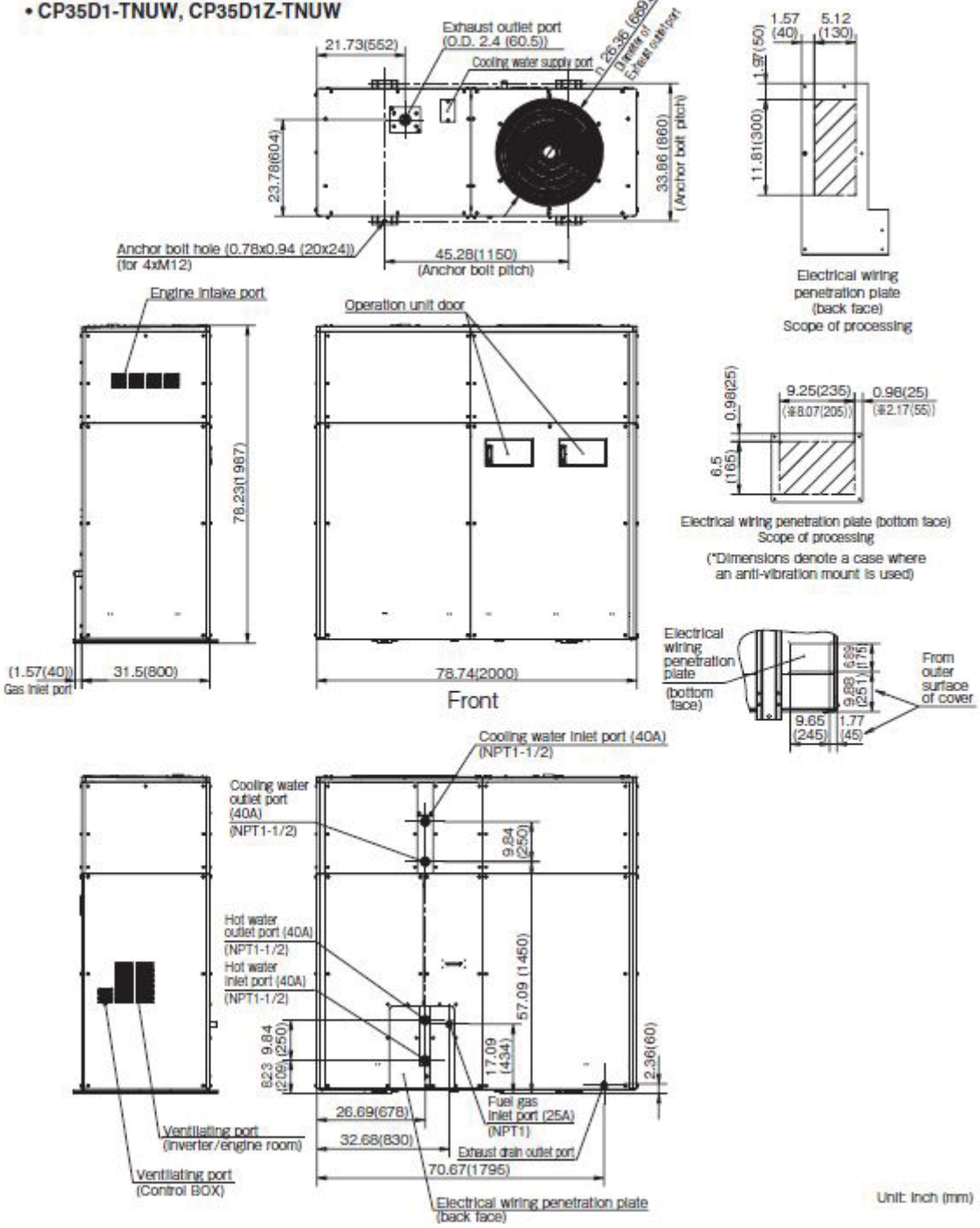
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CP35D1

[Radiator less specification]

• CP35D1-TNUW, CP35D1Z-TNUW



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The Leader In IT Energy Managment and Efficiency

TAKE CONTROL OF YOUR PC & PRINTER FLEETS

Verdiem uniquely monitors end user computing and print devices and provides IT with actionable data to increase efficiency and reduce costs, 30% or more. Verdiem also delivers a 90%+ success rate in waking up PCs for patches and other software updates.

GUARANTEED SOFTWARE UPDATE SUCCESS

- Enhanced Wake-on-LAN that requires no router or security changes
- Automatically elects proxies across all subnets
- Integrates with SCCM, automatically monitoring for advertisements
- Overcome Windows sleep disorders, ensuring PCs will properly wake-up, sleep, or shutdown
- Run system maintenance applications and reboot systems from a central console
- Automate custom processes when systems wake or before being put to sleep
- Report system health information

END USER PRINT OPTIMIZATION

- Inventory of printer makes and models
- Print volumes by department, location, users, and printer model
- Prescriptive guidance & cost savings on printers via elimination /shift to lower cost printers

"…if you're a Microsoft shop and you use Active Directory and Configuration Manager for deployments, Verdiem integrates both components seamlessly and we were extremely impressed with how we could leverage our existing implementations of both Active Directory and System Center Configuration Manager to deploy and then manage Verdiem."

"…because Verdiem allows us to remotely wake PCs with a simple website, we've actually solved a major help desk and support problem that we've had. People are actually able to turn their PCs on from home remotely and then able to do work off-line off-hours. So that was a very unforeseen benefit."

- Ryan Harvey,
Manager Design & IT,
University of Pittsburgh Medical Center

Verdiem®
by Aptean

The Leader In IT Energy Managment and Efficiency

BASIC PC POWER MANAGEMENT CAPABILITIES	SCCM '12	VERDIEM
Centralized Control and Administration	✓	✓
Collection-based Policies	✓	✓
Support for Simple Power Policies	✓	✓
Basic Usage and Savings Reporting	✓	✓
Support for Windows (XP, Vista, Windows 7 & 8)	✓	✓
Sleep, Hibernate, Shutdown	✓	✓
Display Standby	✓	✓
Active Directory Integration	✓	✓

REQUIRED ENTERPRISE CAPABILITIES	SCCM '12	VERDIEM
Proven Network Proxy Driven Wake-On-WAN		✓
Supports Wake-on-Web for Remote User Access		✓
Print Resource Analytics		✓
Auto Synchronization of Wake and Updating		✓
One-Click PC Sleep Disorder Resolution		✓
Real-time Control of PC Power States		✓
Executive-Level Sustainability Dashboard		✓
Multiple Intraday Power Policies		✓
Graceful Shutdown of Open Applications/Data		✓
Historical Data Retention and Advanced Reporting		✓
Support for Mac OS		✓
API Driven Tools for Enterprise Automation		✓
Location-based Utility Rate Driven Reporting		✓
Support wake-up for 802.1X networks		✓
Identifies wasted/unused systems with analytics		✓

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Aptean Verdiem Surveyor

Power Management for Microsoft and Mac

As a power management solution for PCs, Macs, and Windows tablets, Aptean Verdiem Surveyor provides a unified approach for IT device data collection, policy management, administration, and analytics. Surveyor offers the most accurate approach to energy management and measurement and can reduce your IT energy costs up to 60%.

Optimize Savings and Improve Energy Efficiency

Surveyor helps accurately measure computer and tablet energy consumption, allowing you to enforce policies for greater energy efficiency and optimize savings.

Surveyor delivers three IT efficiency solutions in a single integrated product:

- **PC Power Management** – Reducing PC energy usage starts with establishing a baseline of current energy usage data. Surveyor automatically detects and groups devices to capture accurate energy usage data and leverages the data to reduce power consumption.
- **Enterprise PC Wake** – Surveyor reliably wakes the PC fleet for security updates and patch management.
- **End User Print Analytics** – Uniquely monitor end user print activity and compile actionable data for devices and the people who use them.

Learn More

To learn more, contact your Account Manager or email us at **info@aptean.com**.

Benefits

- Improve security and compliance by achieving 95%+ wake success for patching
- Increase energy savings by an additional 30-60%
- Reduce IT labor and costs
- Streamline the administration of endpoint devices
- Enhance analytics capabilities with exhaustive reports that use the very detailed data collected on energy usage, savings opportunities and underutilized devices

Honeywell

Demand Control Ventilation Economizer – W7220

SPECIFICATION DATA



FEATURES

- **24 VAC; operates between -40° to 150° F.**
- **Surpasses UL 60730 and UL 94-5 plenum flammability tests.**
- **California Title 24 compliant.**
- **Integrates with the space temperature control system recommended by the HVAC unit (conventional or heat pump) manufacturer.**
- **Demand Control Ventilation (DCV) CO2 sensor varies the ventilation damper's minimum ventilation position between two adjustable values (one for low or highly variable occupancy and one for full occupancy) to reduce outside air during low occupancy periods.**
- **Energizes one or two supplemental exhaust fans during operation, complete with exhaust cycle setpoint(s).**
- **Displays status for:**
  - **Economizing**
  - **Occupancy**
  - **Calls for cooling from room controller**
  - **Mixed air temperature**
  - **Outdoor air temperature**
  - **Return air temperature**
  - **CO2 level in space**
  - **DCV on/off and exhaust fan on/off Actuator status**
- **Includes discharge or mixed air sensor to control mixing dampers.**
- **Fault detection and diagnostic capabilities with alarms for failed sensors and communicating actuator.**

Guide Specifications:

1. W722X Economizer control module shall be 24 Vac and UL 60730, UL94-5 plenum flammability, CE and FCC compliant. Suitable for operation between -40 to 150 F and complies with \California Title 24.
2. Module shall be compatible with and integrated into the space temperature control system as recommended by the HVAC unit (conventional or heat pump) manufacturer.
3. Module shall be provided with a Demand Control Ventilation (DCV) CO2 sensor for room mounting which varies the ventilation dampers' minimum ventilation position between two adjustable values (one for low or highly variable occupancy and one for full occupancy) to reduce outside air cfm during low occupancy periods.
4. The module shall have an output to energize one or two supplemental exhaust fans during DCV operation complete with exhaust cycle setpoint(s).
5. The module shall have status for economizing, occupancy, calls for cooling from room controller, mixed air temperature, outdoor air temperature, return air temperature, CO2 level in space, DCV on/off and exhaust fan on/off.
6. Module shall include discharge or mixed air sensor to control mixing dampers during periods when outside air is sensed as suitable for free cooling.
7. Module shall be designed for mounting with appropriate Honeywell damper actuator.
8. Module will have fault detection and diagnostic capabilities with alarms for failed sensors.

c UL US LISTED

63-1363EF-01

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Honeywell

C7632A,B
Sensor and Controller
CARBON DIOXIDE SENSOR

PRODUCT DATA



C7632B

C7632A

APPLICATION

The C7632 Sensor and Controller is a stand-alone carbon dioxide (CO_2) sensor for use in determining ventilation necessity with heating ventilation and air conditioning (HVAC) controllers. The C7632 measures the CO_2 concentration in the ventilated space or duct. The C7632 is used in HVAC systems to control the amount of fresh outdoor air supplied to maintain acceptable levels of CO_2 in the space.

FEATURES

- **Non-Dispersion-Infrared (NDIR) technology used to measure carbon dioxide gas.**
- **Special plated sensor provides long-term calibration stability.**
- **Device provides voltage output based on CO_2 levels.**
- **Used for CO_2 based ventilation control.**
- **Automatic Background Calibration (ABC) algorithm based on long-term evaluation reduces required typical zero-drift check maintenance.**
- **Fixed 0 to 10 Vdc from 0 to 2000 ppm. No adjustments are necessary.**
- **Compatible with Honeywell Excel 10, 15, 5000, and any controller requiring 0-10 Vdc input.**

SPECIFICATIONS

Models: C7632 Sensor and Controller. A stand-alone carbon dioxide (CO_2) sensor with one 0-10 Vdc analog output.
C7632A: Wall mount model.
C7632B: Duct mount model.

Dimensions:
C7632A: See Fig. 1.
C7632B: See Fig. 2.

Ambient Ratings:
Temperature:
Operating: +32°F to +122°F (0°C to +50°C).
Storage: -4°F to +158°F (-20°C to +70°C).
Relative Humidity (non-condensing): 0 to 95 percent.

Automatic Background Calibration (ABC) default: On.

Electrical Ratings:
Power Supply: 24 Vac ±20%, 50/60 Hz (Class 2).
Maximum Power Consumption:
Average: 1W.
Peak: 2W.
Peak Current (at 20 ms): 300 mA.
Linear Analog Output: 0-10 Vdc.

Mounting:
C7632A: Vertical surface with standard single-gang junction box.
C7632B: Sheet metal duct with a sampling tube.

CO_2 Pressure Dependence: 1.6% change in reading per 1 kPa deviation from 100 kPa.

Output: Analog: 0-10 Vdc, 0-2000 ppm (fixed).

Sensor Performance Ratings:
Response Time: 1 min.
Carbon Dioxide Sensor:
Operation: Non-dispersive infrared (NDIR).
Sampling: Diffusion.
Range: 0 to 2000 ppm (fixed).
Annual Drift: ±10 ppm (nominal).
Accuracy: ±(30 ppm+2%) at normal temperature/pressure.
Calibrated at the factory.
Uses automatic background calibration. No calibration required for the life of the product.
Meets CEC Title 24 requirement of ±75ppm accuracy at 600ppm and 1000ppm ambient levels.
For proper CO2 operation, install only in spaces that see at least 4 hours of continuous unoccupied time per week.

63-2615-07

Wiring Connections:
C7632A: Terminal block.
C7632B: 20-gauge cable with three 6 in. leadwires.

Approvals:
CE.
C7632B: Flammability Rating, UL94-5V.
C7632A: NEMA1.
C7632B: NEMA3.

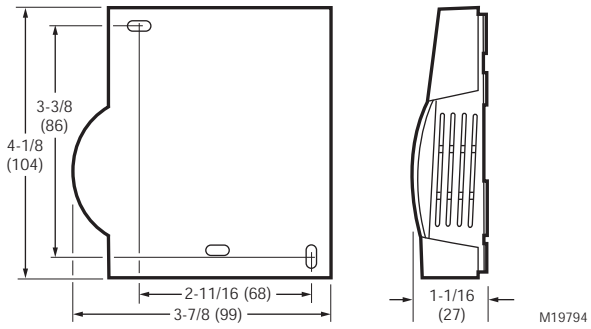


Fig. 1. C7632A dimensions in in. (mm).

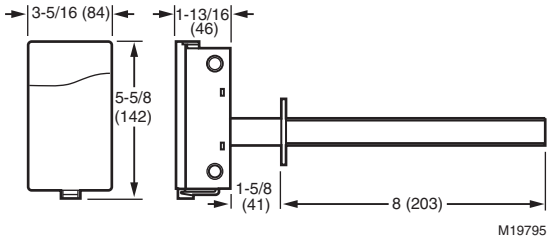


Fig. 2. C7632B dimensions in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

IMPORTANT

All wiring must agree with applicable codes, ordinances and regulations.

⚠ CAUTION
Health Hazard.
Improper use can create dangerous situations.
Use in application for sensing carbon dioxide only. For life-safety applications, this device can function only as a secondary or lesser device.

⚠ CAUTION
Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

⚠ CAUTION
Equipment Damage Hazard.
Electrostatic discharge can short equipment circuitry.
Ensure that you are properly grounded before handling the unit.

C7632A Cover Removal/ Replacement

The cover of the C7632A is fixed by a latch on the underside of the unit.

C7632A Cover Removal (see Fig. 3)

1. Unless the device is mounted, hold the base using the wiring hole and/or the perforated vent.
2. Depress the tab on the underside of the device.
3. Swing the cover away from the base.
4. Lift cover from base.

C7632A Cover Replacement

1. Place top cover tab over the ridge along the base top.
2. Swing the cover down.
3. Press the lower edge of the case to latch.

Location and Mounting

C7632 Sensors mount directly on the wall, sheet metal duct, or a panel. When planning the installation, allow enough clearance for maintenance and service. Mount the sensor in a well-ventilated area.

NOTES: Do not install the sensor where it can be affected by: — drafts or dead spots behind doors and in corners.
— air from ducts.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number. If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Environmental and Combustion Controls Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386
3. http://customer.honeywell.com or http://customer.honeywell.ca

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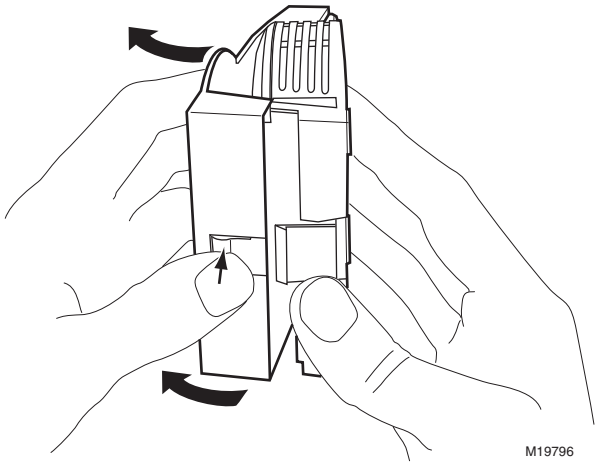


Fig. 3. C7632A cover removal.

Wall Mounting (C7232A)

Mount the C7232A to the wall as follows:

1. Remove the C7632 cover.
2. Mount the device in a vertical position.
3. Mount the subbase directly on a wall using the type of screws (not supplied) appropriate for the wall material.
4. Replace the cover.

Junction Box Mounting (Fig. 4)

Mount the C7232A to a junction box as follows:

1. Attach the wallplate using only the top screw.
2. Remove the C7632 cover.
3. Place the subbase on the wallplate hook.
4. Mount the subbase and wallplate to the junction box using the lower screw.
5. Replace the cover.

Duct Mounting (see Fig. 5)

1. Place gasket on aspiration tube.

IMPORTANT

Ensure largest tab at tube control end is at the top.

2. Insert tube into duct; attach using screws and washers.

IMPORTANT

Leakage into the duct or the C7632 box cover from the room will skew the sensor readings. Ensure the box cover and duct seal completely.

3. Place o-ring on tube end; mount the control to the tube.

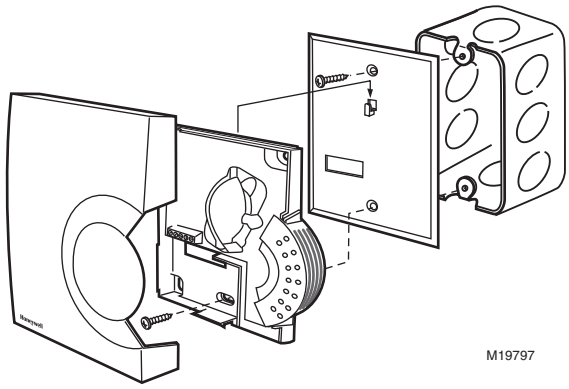


Fig. 4. Junction box mounting (C7632A).

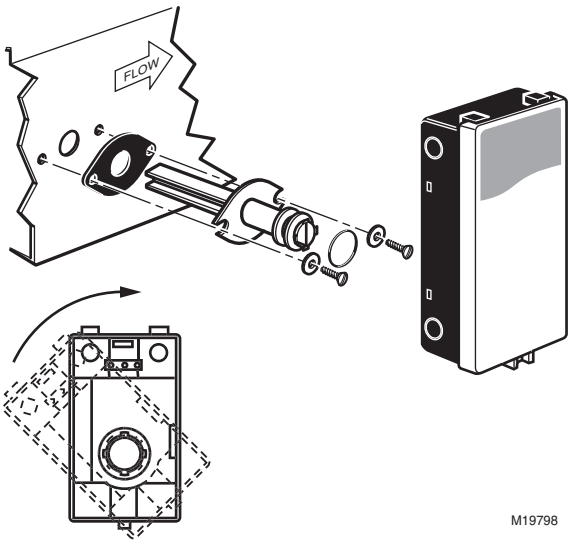


Fig. 5. Duct mounting (C7632B).

WIRING (FIG. 6)

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

⚠ CAUTION

Equipment Damage Hazard.
Electrostatic Discharge Can Short Equipment Circuitry.

Ensure that you are properly grounded before handling the unit.

IMPORTANT

1. *All low voltage connections to this device must be 24 Vac Class 2.*
2. *All wiring must comply with applicable local codes, ordinances and regulations.*

Table 1. C7632 Wiring Connections (see Fig. 6).

Designation	C7632B Wire Color	Function
G+	Red	24 Vac
G0	Black	Common
CO_2	Brown	Analog Output Signal

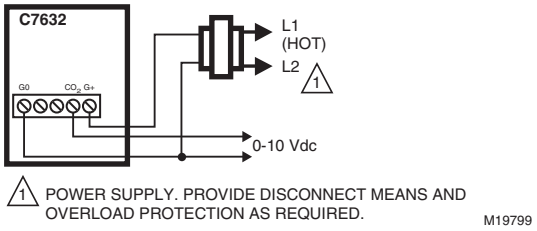


Fig. 6. Wiring the C7632.

Output (Table 2)

Table 2. 0-10 Vdc Output Signal.

CO2 Level (ppm)	0	200	400	600	800	1000	1200	1400	1600	1800	2000
Voltage Output (Vdc)	0	1	2	3	4	5	6	7	8	9	10

CALIBRATION

Typically, calibration is unnecessary. No calibration kits are available. However, if CO_2 levels can be brought to a desirable level, the sensor can be reset using either zero or background calibration:

IMPORTANT

- *With zero calibration, all CO_2 present during calibration skews the sensor zero level.*
- *Using background calibration, practical operation (with a higher than zero level set) can be obtained.*

Zero Calibration

1. Remove the sensor cover and set it aside.
2. Apply a steady flow of CO_2-free gas at 0.1 to 0.5 liter per minute into the gas inlet tube located on the gold sensor.
3. Execute calibration by shorting the proper two soldering pads (see Fig. 7).

   NOTE: The device should now provide accurate output.

4. Check the output signal. (See Checkout section.)
5. Reinstall the device.

Background Calibration

1. Remove the sensor cover and set it aside.
2. Ventilate the area and reduce occupancy to lower the CO_2 levels.
3. Maintain a reasonable proximity from the sensor to avoid breathing on it, thus skewing calibration accuracy.
4. Keep the sensor in this environment for three to four minutes.
5. Execute calibration by shorting the proper two soldering pads (see Fig. 7).

   NOTE: The device should now provide accurate output.

6. Check the output signal. (See Checkout section.)
7. Reinstall the device.

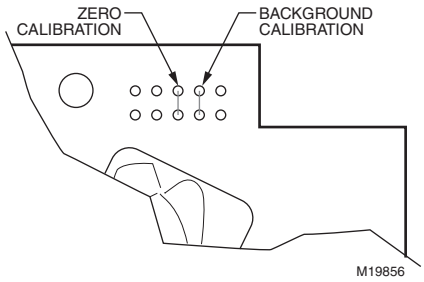


Fig. 7. C7632 calibration pads.

CHECKOUT

Perform a quick test of the unit with the unit powered:

1. After calibration:
   a. Check output signal immediately following proper calibration (with minimum environmental change):
      (1) Proper zero calibration: 0 Vdc.
      (2) Typical background calibration: 2 Vdc. Depending on ambient CO_2 level, range: 1.75 to 2.5 Vdc.
   b. If the output is incorrect, repeat calibration procedure.
   c. Otherwise, continue with checkout.
2. Stand close to the unit and breathe air into the sensor.

   NOTE: When connected to a damper in a ventilation system, breathing on the sensor typically signals an increase in air flow.

3. Check the output to ensure a strong rise in CO_2 level.

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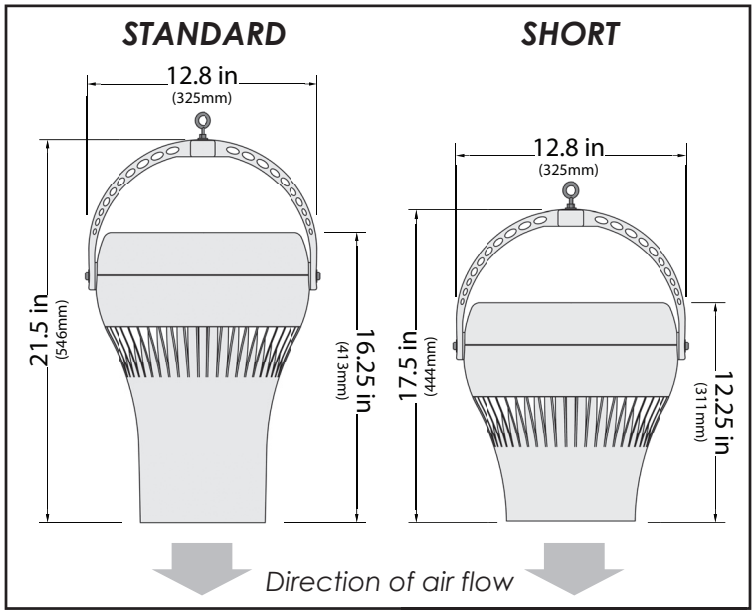
AIR PEAR 25-SP DESTRATIFICATION FAN SUBMITTAL

SPECIFICATION SECTION: 23 34 00 - HVAC FANS

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	**dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
A-25-SP	120	50/60	0.30/0.32	30/35	1500/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-SP	230	50/60	0.14/0.13	31/33	1450/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-SP	277	50/60	0.13/0.17	35/45	1500/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²

**0-static motor data supplied by fan manufacturer. Subject to change at any time.*

***Sound pressure level at 3 feet. Sound Power Level 58 dB(A), designed to meet ISO 3744 – engineering grade precision for determining sound power.*



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC

Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
A (Air Pear)	25	SP (Shaded Pole)	(Short) SH (Standard) STD	120 230 277	(Off White) W (Gray) G (Black) B

EXAMPLE: A - 25 - SP - **STD - 120 - W**

- **Color**
- **Voltage (AC)**
- **Nozzle Length**
- Motor Type
- Model
- Style

DESTRATIFICATION FAN DESCRIPTION

The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season.

CERTIFICATION: *Conforms to UL-507, CAN/CSA C22.2#60335-1, UL 94 5VA and is ETL listed in USA and Canada.*

HOUSING: *PC/ABS resin, 5VA flame resistance rating*

MOTOR: *Single phase, shaded pole, single speed (variable with optional speed control), axial motor. Motor is thermally protected. Operating temperature: -4˚ F (-20˚ C) to 158˚ F (70˚ C). No lubrication required. Bearings are sealed. 6' cord and plug provided for 120V, no plug for 230V.*

STATOR: *Patented multi-vane stator significantly increases air throw for maximizing performance. PC/ABS.*

SAFETY CABLE: *6' length steel cable (fastened to body)*

WARRANTY*: Warranty - 3-years parts and workmanship. Money back guarantee - 30 days. Refurbish program after 3-year warranty period.*

FACTORY INSTALLED OPTIONS:

Item #	Description	Qty
PHI-9-C	Factory installed 9 in. PHI cell	
PHI-5-C	Factory installed 5 in. PHI cell	
GUARD25	Silver intake grille	

ACCESSORIES *(additional costs apply)*

Speed Control *(coordinate w/ electrical requirement)*

Item #	Description	Qty
TRIAC-120-1.5	120VAC, 1.5A wall mounted speed control	
TRIAC-120-5	120VAC, 5A wall mounted speed control	
TRIAC-120-15	120VAC, 15A wall mounted speed control	
TRIAC-230-8	230VAC, 8A wall mounted speed control	
TRIAC-277-5	277VAC, 5A wall mounted speed control	
TRIAC-SMART-7.5	95-250VAC, 7.5A, electrical box speed control	

COLOR OPTIONS:

"Off White" Cool Gray 2C *"Gray" Gray 432C* *Black*

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811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@airiusfans.com, www.airiusfans.com

May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

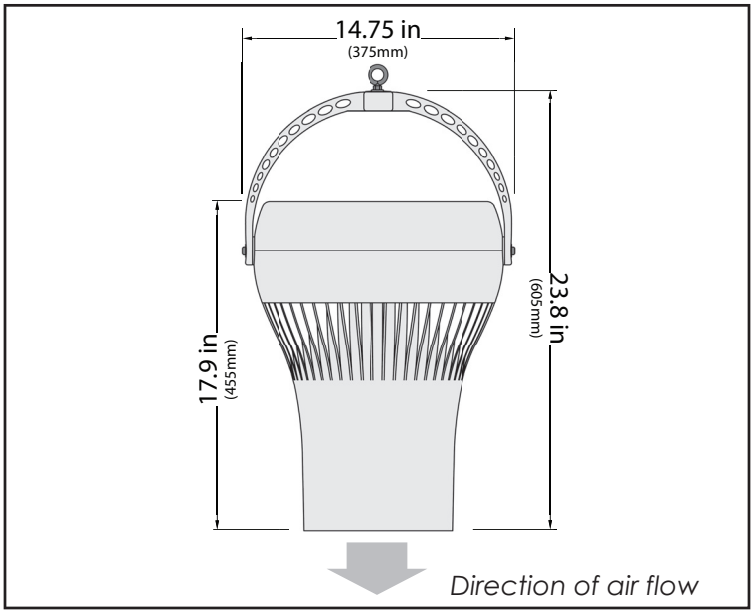
AIR PEAR 45-P4 DESTRATIFICATION FAN SUBMITTAL

SPECIFICATION SECTION: 23 34 00 - HVAC FANS

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	**dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
A-45-P4	120	50/60	0.40/0.41	44/46	1400/1650	595/715	54	14 lb	Up to 38 ft.	Up to 1200 ft²
A-45-P4	230	50/60	0.19/0.2	42/45	1450/1630	595/707	54	14 lb	Up to 38 ft.	Up to 1200 ft²
A-45-P4	277	50/60	0.19/0.2	42/45	1450/1630	595/707	54	14 lb	Up to 38 ft.	Up to 1200 ft²

*0-static motor data supplied by fan manufacturer. Subject to change at any time.

**Sound pressure level at 3 feet. Sound Power Level 66 dB(A), designed to meet ISO 3744 – engineering grade precision for determining sound power.



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC

Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
A (Air Pear)	45	P4 (permanent split capacitor)	(Standard) STD	**120** **230** **277**	**(Off White) W** **(Gray) G** **(Black) B**

EXAMPLE: A - 45 - P4 - STD - **120 - W**

- **Color**
- **Voltage (AC)**
- Nozzle Length
- Motor Type
- Model
- Style

DESTRATIFICATION FAN DESCRIPTION

The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season.

CERTIFICATION: *Conforms to UL-507, CAN/CSA C22.2#60335-1, UL 94 5VA and is ETL listed in USA and Canada.*

HOUSING: *PC/ABS resin, 5VA flame resistance rating*

MOTOR: *Permanent Split Capacitor, single speed (variable with optional speed control), axial motor. Motor is thermally protected. Operating temperature: -13˚ F (-25˚ C) to 158˚ F (70˚ C). No lubrication required. Bearings are sealed. 6' cord and plug provided for 120V, no plug for 230/277V*

GUARD GRILLE: *Steel, phosphated and coated in black plastic*

STATOR: *Patented multi-vane stator significantly increases air throw for maximizing performance. PC/ABS.*

SAFETY CABLE: *6' length steel cable (fastened to body)*

WARRANTY*: Warranty - 3-years parts and workmanship. Money back guarantee - 30 days. Refurbish program after 3-year warranty period.*

FACTORY INSTALLED OPTIONS:

Item #	Description	Qty
PHI-9-C	Factory installed 9 in. PHI cell	

ACCESSORIES *(additional costs apply)*

Speed Control *(coordinate w/ electrical requirement)*

Item #	Description	Qty
TRIAC-120-1.5	120VAC, 1.5A wall mounted speed control	
TRIAC-120-5	120VAC, 5A wall mounted speed control	
TRIAC-120-15	120VAC, 15A wall mounted speed control	
TRIAC-230-8	230VAC, 8A wall mounted speed control	
TRIAC-277-5	277VAC, 5A wall mounted speed control	
TRIAC-SMART-7.5	95-250VAC, 7.5A, electrical box speed control	

COLOR OPTIONS:

"Off White" Cool Gray 2C — "Gray" Gray 432C — Black

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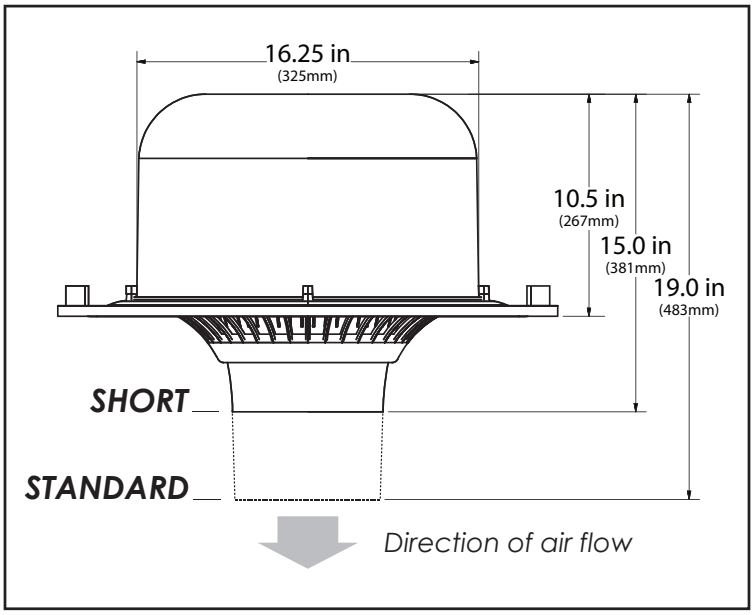
AIR PEAR SUSPENDED 15-SP DESTRATIFICATION FAN SUBMITTAL

SPECIFICATION SECTION: 23 34 00 - HVAC FANS

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	**dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
S-15-SP	120	50/60	0.11/0.14	13.5/17	1230/1260	406	29	16 lb	Up to 18 ft.	Up to 800 ft²
S-15-SP	230	50/60	0.06/0.07	15/17	1230/1260	406	29	16 lb	Up to 18 ft.	Up to 800 ft²

**0-static motor data supplied by fan manufacturer. Subject to change at any time.*

***Sound pressure level at 3 feet. Sound Power Level 44 dB(A), designed to meet ISO 3744 – engineering grade precision for determining sound power.*



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
CONFIGURATION	
QUANTITY	

ORDERING LOGIC

Enter part number into the configuration field above

Style	Model	Motor Type	Nozzle Length	Voltage	Color
S (Suspended)	15	SP (Shaded Pole)	**(Short) SH (Standard) STD**	**120 230**	**(Off White) W (Black) B**

EXAMPLE: S - 15 - SP - **STD - 120 - W**

- **Color**
- **Voltage (AC)**
- **Nozzle Length**
- Motor Type
- Model
- Style

DESTRATIFICATION FAN DESCRIPTION

The patented Air Pear Thermal Equalizer creates uniform air temperatures from floor to ceiling for maximum thermal comfort and energy savings up to 35% in the heating season and up to 25% in the cooling season.

CERTIFICATION: *Conforms to UL-507, CAN/CSA C22.2#60335-1, UL 94 5VA and is ETL listed in USA and Canada.*

HOUSING: *PC/ABS resin, 5VA flame resistance rating*

MOTOR: *Single phase, shaded pole, single speed (variable with optional speed control), axial motor. Motor is thermally protected. Operating temperature: -4˚ F (-20˚ C) to 158˚ F (70˚ C). No lubrication required. Bearings are sealed. A junction box and receptacle are supplied. Electrical contractor will need to provide MC cable and wire directly to j-box/receptacle mounted to side of dome.*

STATOR: *Patented multi-vane stator significantly increases air throw for maximizing performance. PC/ABS.*

WARRANTY*: Warranty - 3-years parts and workmanship. Money back guarantee - 30 days. Refurbish program after 3-year warranty period.*

FACTORY INSTALLED OPTIONS:

Item #	Description	Qty
PHI-9-C	Factory installed 9 in. PHI cell	
PHI-5-C	Factory installed 5 in. PHI cell	
GUARD25	Silver intake grille	

ACCESSORIES *(additional costs apply)*

Speed Control *(coordinate w/ electrical requirement)*

Item #	Description	Qty
TRIAC-120-1.5	120VAC, 1.5A wall mounted speed control	
TRIAC-120-5	120VAC, 5A wall mounted speed control	
TRIAC-120-15	120VAC, 15A wall mounted speed control	
TRIAC-230-8	230VAC, 8A wall mounted speed control	
TRIAC-SMART-7.5	95-250VAC, 7.5A, electrical box speed control	

COLOR OPTIONS:

"Off White" Cool Gray 2C

Black

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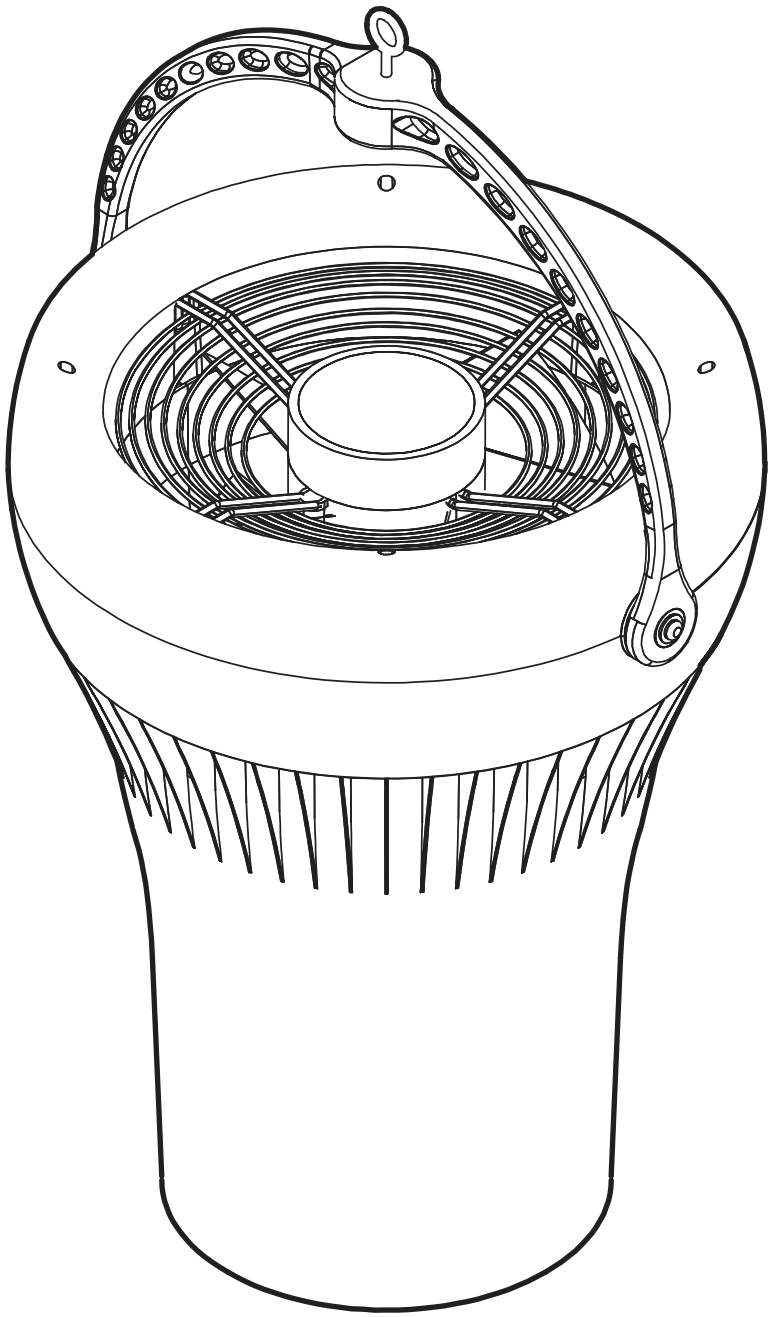
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May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

AIRIUS®

The World Standard
For Destratification

AIR PEAR
INSTALLATION, OPERATION & MAINTENANCE



Air Pear®
THE THERMAL EQUALIZER
BY AIRIUS

Installation Guide: V1.2

May be covered by one or more of the following United States Patents:
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NOTE: Carefully check fans/controls for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate if visible damage is evident to either the circuit or to the electronic components. All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. Airius makes no warranty of any kind with regard to this information or data. Further, Airius is not responsible for any omissions or errors or consequential damage caused by the user of the product. Airius reserves the right to make manufacturing changes that may not be included in this manual.

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PC/ABS

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INTRODUCTION

Thank You!

Congratulations on the purchase of Airius' Thermal Equalizer system (Air Pear). Our patented, American-made, air-mixing system will ensure better thermal comfort in both the summer and winter while driving down expensive energy bills. We are here to support you and if you have any questions or comments, we can be contacted through our website, www.airiusfans.com, or give us a call: 1-888-247-7327.

About Air Pear Models 10, 15, 25, 45, 60 & 100

The Air Pear unit is an energy-efficient air turbine, designed to continuously move a column of air to the floor for destratification and air circulation purposes. A typical system installation includes a series of units mounted just below the ceiling, evenly spaced throughout a facility, working in concert to improve comfort and reduce HVAC energy consumption up to 35% or more*. Airius fans are available in several sizes to accommodate a wide range of ceiling heights.

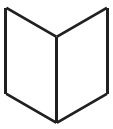
* THE PERFORMANCE AND RESULTS OF THE AIR PEAR SYSTEM ARE SUBJECT TO MANY VARIABLES SUCH AS, BUT NOT LIMITED TO, AIRFLOW OBSTRUCTIONS, THE INTERIOR ENVIRONMENT, EXTERIOR ENVIRONMENT, CONDITION OF BUILDING STRUCTURE, HVAC SYSTEM PERFORMANCE AND/OR ELECTRICAL SERVICE AND THUS, ACTUAL RESULTS MAY VARY.

What's in the Box

Each unit will arrive in its own box, fully assembled. NOTE: 120VAC versions come with a three-prong plug, and other voltages have no plug supplied. You will need to have a qualified electrician either wire the desired plug on to the power cord or hard wire directly to the power circuit. We recommend using a plug for easy removal during maintenance.



Fully Assembled Air Pear or Designer Series fan



Information Sheet



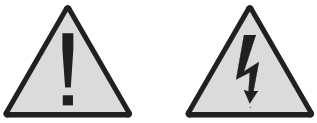
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Motor Information for Air Pear Models 10, 15, 25, 45, 60 & 100

MODEL	VOLTS 1Ø	HZ	*AMPS	*WATTS	*MAX RPM	*MAX CFM	*dB(A)	WEIGHT	MOUNTING HEIGHT	COVERAGE AREA
A-10-SP	120	50/60	0.11/0.13	13/15	1000/1050	318	24	7 lb/9 lb	Up to 12 ft.	Up to 500 ft²
A-10-SP	230	50/60	0.06/0.06	12/13	980/1000	318	24	7 lb/9 lb	Up to 12 ft.	Up to 500 ft²
A-10-EC	100-130	50/60	0.12	7	1000	318	24	7 lb/9 lb	Up to 12 ft.	Up to 500 ft²
A-10-EC	200-250	50/60	0.06	7	1000	318	24	7 lb/9 lb	Up to 12 ft.	Up to 500 ft²
A-15-SP	120	50/60	0.11/0.14	13.5/17	1230/1260	406	29	7 lb/9 lb	Up to 18 ft.	Up to 800 ft²
A-15-SP	230	50/60	0.06/0.07	15/17	1230/1260	406	29	7 lb/9 lb	Up to 18 ft.	Up to 800 ft²
A-15-EC	100-130	50/60	0.17	11	1260	406	29	7 lb/9 lb	Up to 18 ft.	Up to 800 ft²
A-15-EC	200-250	50/60	0.08	11	1260	406	29	7 lb/9 lb	Up to 18 ft.	Up to 800 ft²
A-25-SP	120	50/60	0.30/0.32	30/35	1500/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-SP	230	50/60	0.14/0.13	31/33	1450/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-SP	277	50/60	0.13/0.17	35/45	1500/1650	459/547	45	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-EC	100-130	50/60	0.4	30	1700	620	51	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-25-EC	200-250	50/60	0.26	30	1700	620	51	7 lb/9 lb	Up to 25 ft.	Up to 1200 ft²
A-45-P4	120	50/60	0.40/0.41	44/46	1400/1650	595/715	54	14 lb	Up to 38 ft.	Up to 1200 ft²
A-45-P4	230	50/60	0.19/0.2	42/45	1450/1630	595/707	54	14 lb	Up to 38 ft.	Up to 1200 ft²
A-45-P4	277	50/60	0.19/0.2	42/45	1450/1630	595/707	54	14 lb	Up to 38 ft.	Up to 1200 ft²
A-45-P2	120	50/60	1.05/1.48	120/175	2550/2700	1057/1128	64	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-P2	230	50/60	0.54/0.7	125/165	2450/2600	1072/1160	64	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-P2	277	NA/60	NA/0.7	NA/190	NA/2900	NA/1301	64	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-EC	100-130	50/60	0 - 2.2	0 - 170	0 - 2850	0 - 1180	71	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-EC	200-277	50/60	0 - 1.4	0 - 175	0 - 3050	0 - 1290	71	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-EL	100-130	50/60	0 - 2.2	0 - 170	0 - 2850	0 - 1180	71	14 lb	Up to 45 ft.	Up to 1500 ft²
A-45-EL	200-277	50/60	0 - 1.4	0 - 175	0 - 3050	0 - 1290	71	14 lb	Up to 45 ft.	Up to 1500 ft²
A-60-P4	120	50/60	0.91/0.92	88/108	1400/1620	1443/1665	60	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-P4	230	50/60	0.57/0.66	120/150	1390/1600	1667/1902	60	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-P4	277	50/60	NA/0.68	NA/170	NA/1660	NA/2002	60	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-EC	100-130	50/60	0 - 2.2	0 - 170	0 - 1660	0 - 1825	63	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-EC	200-277	50/60	0 - 1.3	0 - 170	0 - 1630	0 - 1770	63	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-EL	100-130	50/60	0 - 2.2	0 - 170	0 - 1660	0 - 1825	63	22 lb	Up to 60 ft.	Up to 2000 ft²
A-60-EL	200-277	50/60	0 - 1.3	0 - 170	0 - 1630	0 - 1770	63	22 lb	Up to 60 ft.	Up to 2000 ft²
A-100-EC	100-130V	50/60	0 - 4.2	0 - 350	0 - 1620	0 - 3210	66	45 lb	Up to 100 ft.	Up to 2500 ft²
A-100-EC	200-277V	50/60	0 - 2.5	0 - 390	0 - 1690	0 - 3358	66	45 lb	Up to 100 ft.	Up to 2500 ft²
A-100-EL	200-277V	50/60	0 - 2.5	0 - 390	0 - 1690	0 - 3358	66	45 lb	Up to 100 ft.	Up to 2500 ft²

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Safety Precautions - Read & Save



Warning! - To prevent fire, electrical shock or injury, please observe the following:

Electrical work must be performed by a qualified person(s) in accordance with all national and local codes/standards.

Air Pear® Thermal Equalizer® fans
Models 10, 15, 25, 45, 60, &100: all voltages

120V Models:
Supplied with a polarized/grounded plug molded to a 6 ft. (1.8 m) cord. To reduce the risk of electrical shock, this plug is intended to fit in a polarized/grounded outlet only one way. If the plug does not fit fully in the outlet, contact a qualified electrician. Do not attempt to defeat this safety feature.

230V & 277V Models:
Supplied with a 6 ft (1.8 m) cord with a 3-wire pigtail for attachment to a single phase plug rated for the correct voltage; NEMA type: L6-20P or similar, wire color code: UL/CSA: black-live/white-neutral/green-yellow-earth.

Warning! To prevent electrical shock and/or injury, unplug/disconnect unit from power source before you move unit, service unit or remove any part of housing.

Warning! To reduce the risk of fire or electrical shock, do not use models 10, 15 and 25 equipped with shaded pole motors or models 45, 60 and 100 with permanent split capacitor (P.S.C.) motors with any unapproved solid-state speed control device. Models 45, 60, 100 and 125 with electrically commutated motors (labeled as EC or EL) are capable of variable speeds with the proper controls. Contact Airius for additional information regarding variable speed controls and options.

Do not carry the Air Pear/Designer Series unit by the cord. Do not use the cord as a handle. Do not use the cord to attach or hang the product. Be sure to grasp the plug, not the cord, when disconnecting this unit from an electrical outlet.

Do not use this product if it has a damaged cord, faulty plug or any broken housing or motor component. If the supply cord, plug, motor or housing is damaged, it must be serviced or replaced by Airius, its service agents or similarly qualified persons to avoid a hazard.

To prevent damage, which may result in fire or shock hazard, do not expose this product to rain or direct moisture. Do not immerse product into water or allow water to drip into the motor housing. Do not install outdoors or in an area open to the weather. Shut off power to a wet motor at source before servicing.

Spinning blades may inflict eye or other physical injury. Always replace a damaged blade. Disconnect unit from power source first. Contact Airius for replacement blades. Plastic blades are rated 5VA, the highest fire-resistant rating for plastics, and they will not maintain a flame.

Caution! Some Air Pear products have an unguarded impeller/fan blade. Do not use in locations readily accessible to people or animals. Blades may inflict injury when moving or stationary.

To reduce the risk of injury to persons, install product so that bottom of moving fan blade or the lowest moving part is at least 8.2 ft. (2.5 m) above the floor or grade level.

The motor is thermally protected; overheating will cause the motor to stop operating. The motor may restart once normal operating temperatures are achieved. If motor fails to restart, disconnect motor from electric source and contact Airius. Do not disable this safety device or override this safety feature; doing so will void the warranty.

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Safety Precautions - Read & Save (cont.)

Do not use any PVC product (electrical tape) with the fans. If installing a fan in an environment with cutting oils in the air (production machine shop) contact the factory for assistance at 303-772-2633.

Do not position product near furnaces, fireplaces, stoves or other high temperature heat sources. Do not position Air Pear unit such that the downward air column created by the Air Pear will be directly bisected by another source of air flow, such as from another fan or from an open supply register. Do not position the unit close to other objects that will interfere with fan operation. Do not allow fan blades to come into contact with objects that can lock or inhibit the rotor operation.

Service and installation: No lubrication is required. Bearings are sealed. Bail adjustment can be made with a T-30 Torx driver/wrench, or a 5/32" Hex wrench may be used. Other tools for service: T-20 Torx (7/64" Hex) & T-25 Torx (1/8" Hex) and a #2 Phillips screwdriver.

The Air Pear unit is designed to be used with only the electrical voltage identified on the label located in the nozzle and on the bottom of the motor. Connecting to any other voltage could damage the motor and create an electrical hazard and will void warranty. If you have a question, please contact the factory.

Assembling Suspended Ceiling units: See additional instructions for kit included with this pamphlet or located in box containing kit.

Important: Install with hanging device or fastener rated for a minimum of 5x the weight of the unit. **Never use zip ties to hang the fan.** Use care when positioning the unit. To maximize performance, make sure the airflow is unobstructed into the top of the unit and the downward airflow is unobstructed and allowed to reach the floor.

Cleaning: Unplug unit from power source first to prevent electrical shock and to avoid injuries from spinning blades. Caution: Stationary blades can cause injury! You may clean the plastic housing with a warm cloth, using mild detergent only. Do not use petroleum products, thinners, solvents, ammonia, alcohols or other chemicals to clean any part of the Air Pear unit.

USA & Canada – ETL file #3164849 EU - CE

For additional information about
Air Pear® or Designer Series Thermal Equalizer® fans
and other products/accessories visit:

www.airiusfans.com

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PRE-INSTALLATION

Preparing the Work Site - Electrical Installation

ELECTRICAL WORK MUST BE PERFORMED BY A QUALIFIED PERSON(S) IN ACCORDANCE WITH ALL NATIONAL AND LOCAL CODES/STANDARDS.

Airius recommends installing a dedicated circuit only to be used with the Air Pear units. DO NOT wire the units into the lighting circuit, as the system will cycle on and off with the lights, greatly reducing the system's effectiveness.

Outlets are available in many configurations, check with the local electrical contractor to determine the preferred type for the facility. Outlets should generally be mounted vertically unless a "twist/locking" type is being used.

Refer to page 13 for plug wiring directions.
Refer to page 12 for specific model amperage.

To confirm electrical continuity, if possible, plug the Air Pear system into an energized outlet at floor level, similar to the outlet installed in the ceiling, before permanently mounting the Air Pear in the ceiling. Only energize the fan after hands/fingers or loose clothing are removed from/around the fan intake.

CAUTION − Make sure the fan voltage matches the intended power supply before installing. Connecting the fan to the wrong voltage will void warranty.

Preparing the Work Site - Mechanical Installation

A ladder, scissor lift or other suitable means of reaching the installation point will be required.

The Air Pear system is designed to hang vertically 12-to-18 inches below the ceiling of the facility with the discharge pointing to the floor for maximum thermal equalization. NOTE: The bail may be angled, as it is ratcheted for special situations where a vertical air column is undesirable and an angled column would be more effective.

Make sure the air column will have an unimpeded path from the discharge to the floor. **If using the fans in a grocery aisle application, mount the fan a minimum of 3 ft. from the edge of any open reach in case to minimize the possibility of introducing air into the case.**

The free-hanging units are designed to hang vertically and freely from the ceiling on hardware capable of supporting a minimum of five times the weight of the unit. Example - 1/4" (7 mm) diameter steel bolt is rated at a 60 lb. (27 kg.) load.

Hardware that may be used to hang the unit includes, but is not restricted to: hooks, chains, cables, carabiners, bridle rings, beam clamps and bolts. Roof structure, building construction, electrical outlets/service and accessibility will define the appropriate hardware for each installation.

If installing within a suspended ceiling, make sure there are no objects (ducts, sprinklers, conduit, etc.), for clearance purposes, directly above the proposed location of installation and relocate if necessary.

Refer to installation directions on page 16 for further information.

Refer to Suspended Ceiling Kit Assembly and Installation on page 20.

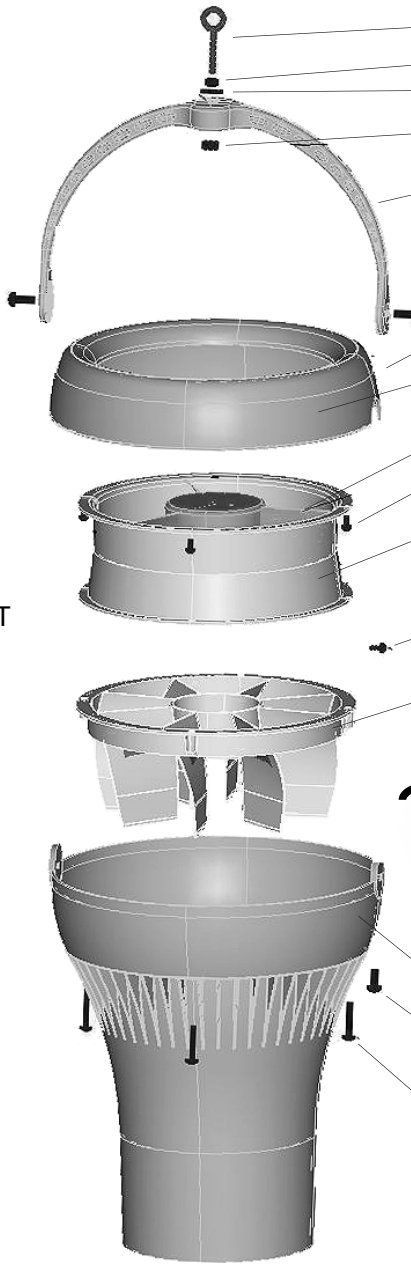
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Tools Needed

T-30 Torx Driver (5/32" Hex); other tools include T-20 Torx (7/64" Hex); T-25 Torx (1/8" Hex); #2 Phillips Driver.
All necessary tools to install mounting hardware (varies from installation to installation)

Fan Diagram 10-SP, 15-SP, 25-SP

AIR PEAR 10-SP, 15-SP, 25-SP



POWER LEADS:

"N" = NEUTRAL

UNMARKED = HOT

1) 1/4 - 20 x 1 1/2 EYE BOLT
2) 1/4 - 20 NUT
3) 1/4 x 5/8 WASHER
4) 1/4 - 20 NYLOCK NUT
5) BAIL/CROSSPIECE
6) 1/4 - 20 x 1 T-30 TORX (5/32 HEX) PAN HEAD MACHINE SCREW x 2 EA.
7) HOLE FOR STRAIN RELIEF SUPPORTING POWER CORD
8) COWL (PC/ABS)
9) FAN BLADES RATED 5VA 1 EA.
10) 8 - 32 x 3/8 T-20 TORX (7/64 HEX) PAN HEAD MACHINE SCREW x 4 EA.
11) ROTOR HOUSING - FAN MOTOR 120 OR 230 VAC THERMALLY PROTECTED (277 VAC AVAILABLE)
12) 8 - 32 x 1/4 T-20 TORX (7/64 HEX) PAN HEAD GROUNDING MACHINE SCREW x 1 EA.
13) STATOR (PC/ABS)
14) STRAIN RELIEF

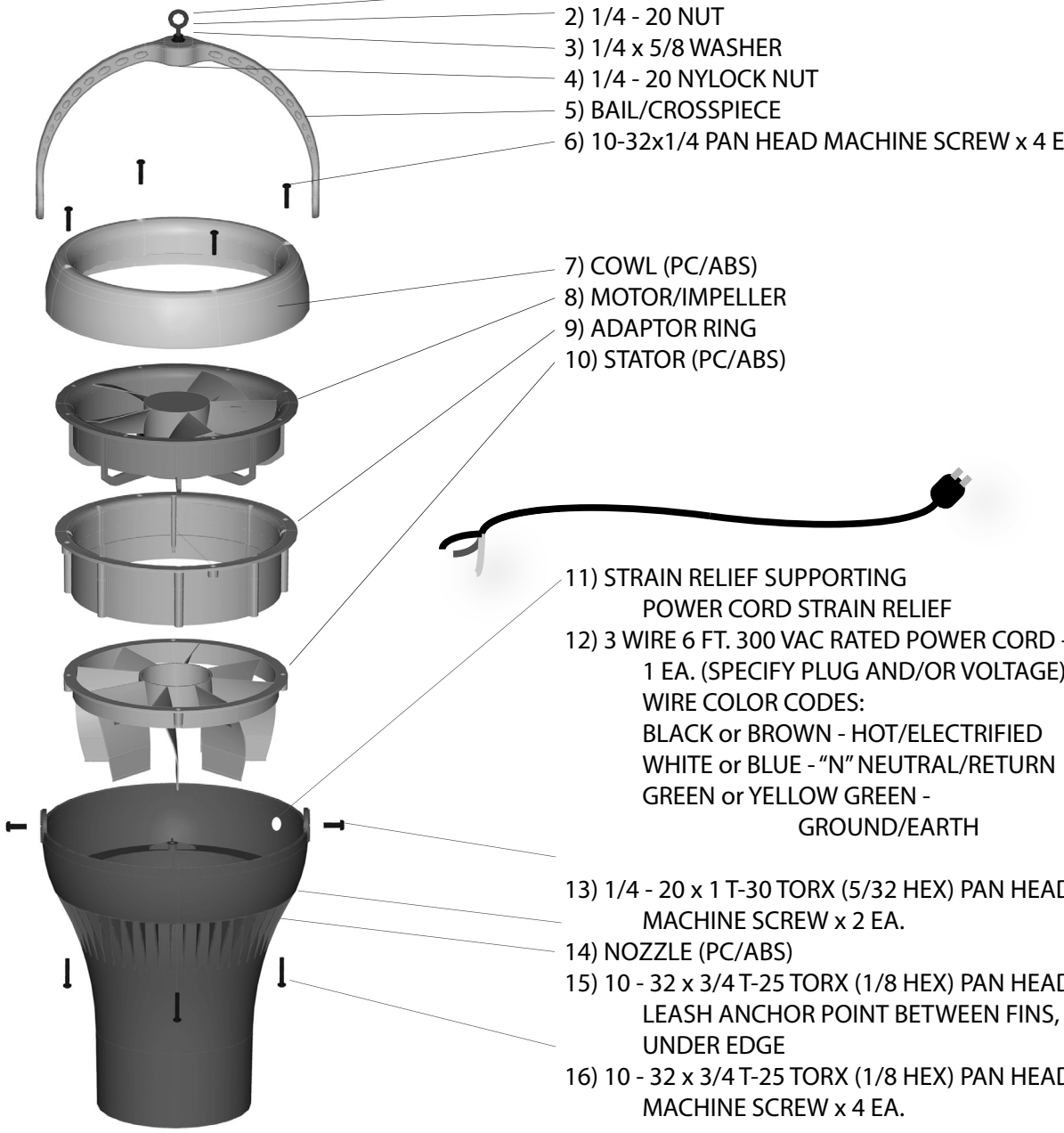


15) 3 WIRE 6 FT. 300 VAC RATED POWER CORD - 1 EA. (SPECIFY PLUG AND/OR VOLTAGE)
WIRE COLOR CODES:
BLACK or BROWN - HOT/ELECTRIFIED
WHITE or BLUE - "N" NEUTRAL/RETURN
GREEN or YELLOW GREEN - GROUND/EARTH

16) NOZZLE (PC/ABS)
17) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) PAN HEAD LEASH ANCHOR POINT BETWEEN FINS, UNDER EDGE
18) 10 - 32 x 1 1/4 T-25 TORX (1/8 HEX) PAN HEAD MACHINE SCREW x 4 EA.

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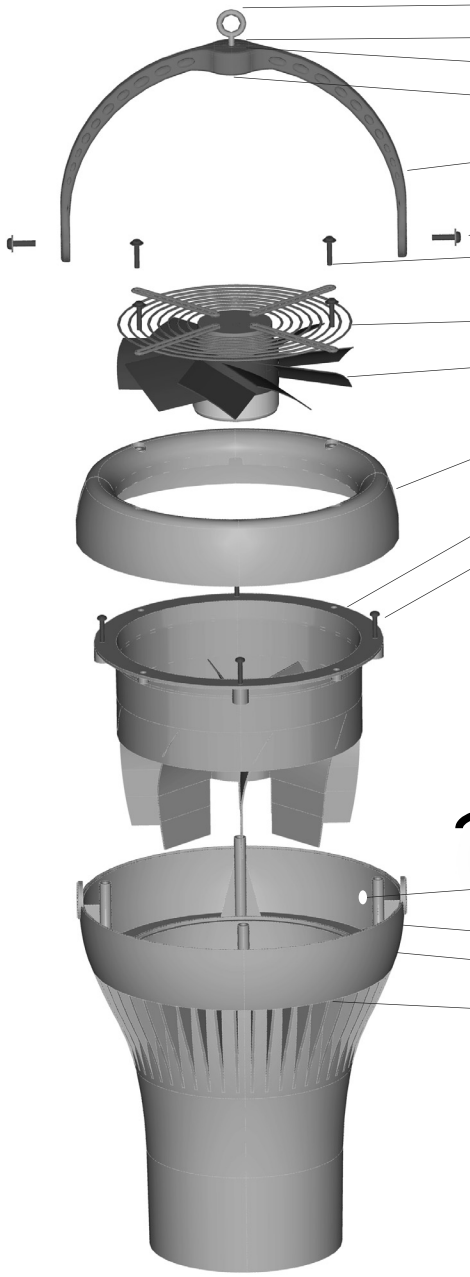
Fan Diagram 10-EC, 15-EC, 25-EC



1) 1/4 - 20 x 1 1/4 EYE BOLT
2) 1/4 - 20 NUT
3) 1/4 x 5/8 WASHER
4) 1/4 - 20 NYLOCK NUT
5) BAIL/CROSSPIECE
6) 10-32x1/4 PAN HEAD MACHINE SCREW x 4 EA.
7) COWL (PC/ABS)
8) MOTOR/IMPELLER
9) ADAPTOR RING
10) STATOR (PC/ABS)
11) STRAIN RELIEF SUPPORTING POWER CORD STRAIN RELIEF
12) 3 WIRE 6 FT. 300 VAC RATED POWER CORD - 1 EA. (SPECIFY PLUG AND/OR VOLTAGE)
WIRE COLOR CODES:
BLACK or BROWN - HOT/ELECTRIFIED
WHITE or BLUE - "N" NEUTRAL/RETURN
GREEN or YELLOW GREEN - GROUND/EARTH
13) 1/4 - 20 x 1 T-30 TORX (5/32 HEX) PAN HEAD MACHINE SCREW x 2 EA.
14) NOZZLE (PC/ABS)
15) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) PAN HEAD LEASH ANCHOR POINT BETWEEN FINS, UNDER EDGE
16) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) PAN HEAD MACHINE SCREW x 4 EA.

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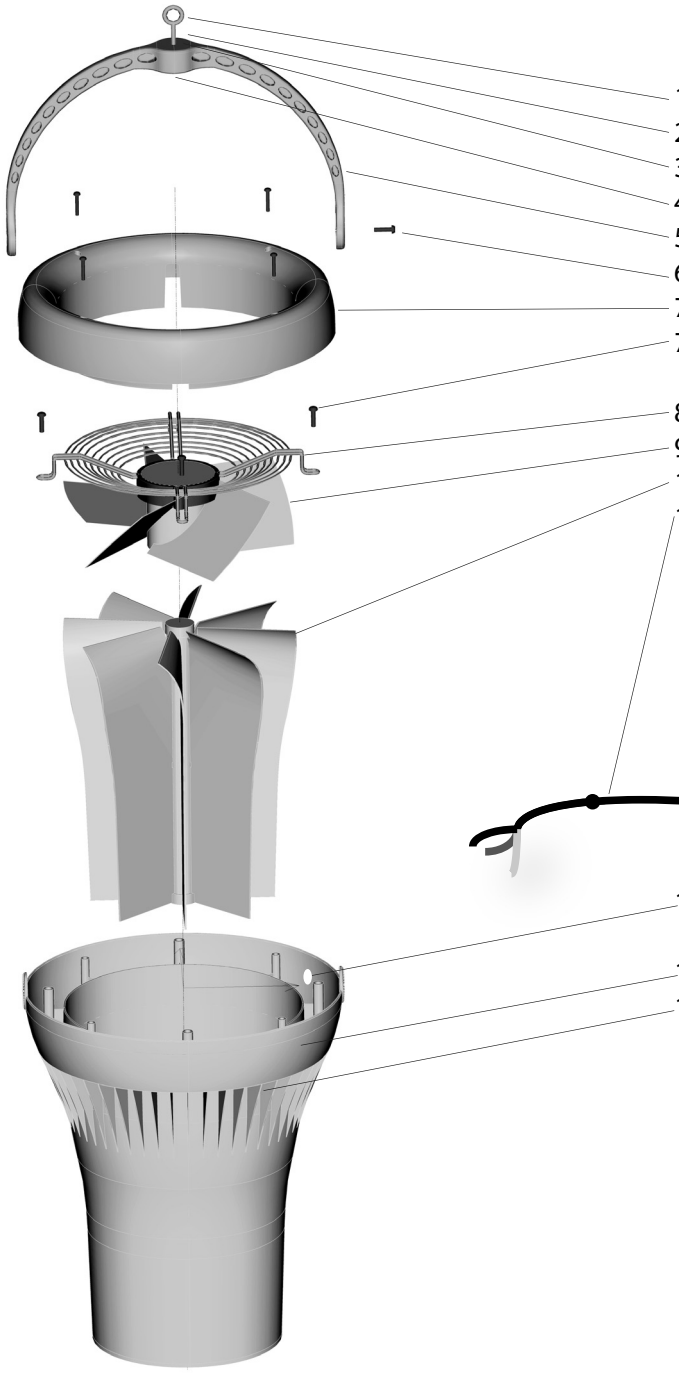
Fan Diagram 45-P4, 45-P2, 45-EC, 45-EL



1) 1/4 - 20 x 1 1/4 EYE BOLT
2) 1/4 - 20 NUT
3) 1/4 x 5/8 WASHER
4) 1/4 - 20 NYLOCK NUT
5) BAIL/CROSSPIECE
6) 1/4 - 20 x 1 T-30 TORX PAN HEAD (x2)
   #10 SAE FLAT WASHER (x2)
7) 10-32 x 2 TORX (x4)
   #10 SAE FLAT WASHER (x4)
8) STEEL GRILLE, PHOSPHATED, BLACK
9) MOTOR/IMPELLER
10) COWL (PC/ABS)
11) STATOR (PC/ABS)
12) 10-32 x 1 1/4" TORX (x4)
13) 3 WIRE 6 FT. 300 VAC RATED POWER CORD - 1 EA. (SPECIFY PLUG AND/OR VOLTAGE)
    WIRE COLOR CODES:
    BLACK or BROWN - HOT/ELECTRIFIED
    WHITE or BLUE - "N" NEUTRAL/RETURN
    GREEN or YELLOW GREEN - GROUND/EARTH
14) HOLE FOR STRAIN RELIEF SUPPORTING POWER CORD
15) HOLE FOR CONTROL WIRES w/ GROMMET
16) NOZZLE (PC/ABS)
17) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) PAN HEAD LEASH ANCHOR POINT BETWEEN FINS, UNDER EDGE

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Fan Diagram 60-P4, 60-EC, 60-EL



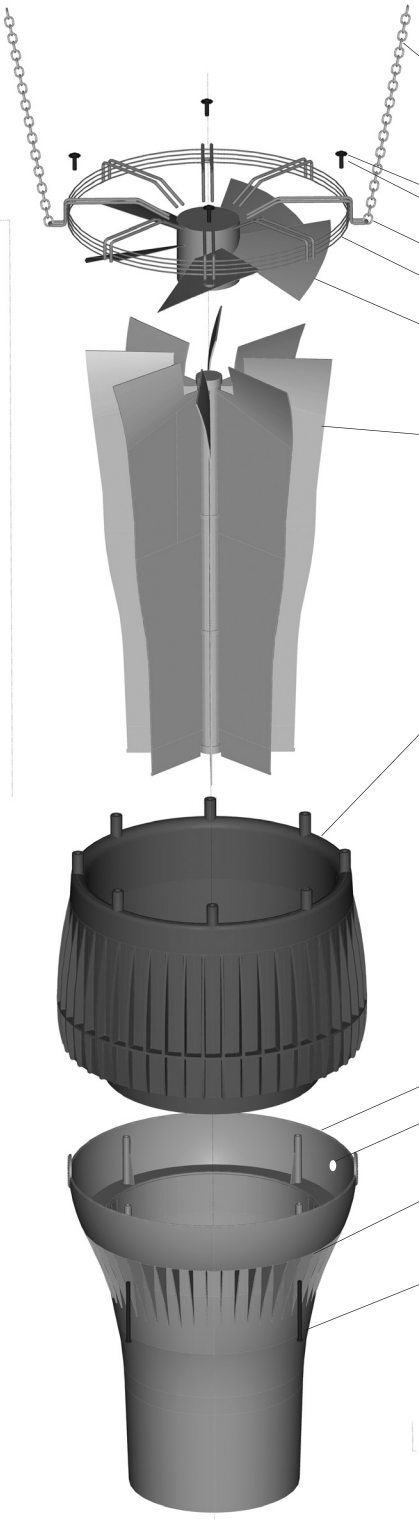
1) 1/4 - 20 x 1 1/4 EYE BOLT
2) 1/4 - 20 NUT
3) 1/4 x 5/8 WASHER
4) 1/4 - 20 NYLOCK NUT
5) BAIL/CROSSPIECE
6) 1/4 - 20 x 1 T-30 TORX PAN HEAD (x2)
7) FAN HOUSING (PC/ABS)
7) 1/4 - 20 x 1 (x4)
#12 SAE FLAT WASHER (x4)
8) STEEL GRILLE, PHOSPHATED, BLACK
9) MOTOR/IMPELLER
10) STATOR (PC/ABS)
11) 3 WIRE 6 FT. 300 VAC RATED POWER CORD - 1 EA. (SPECIFY PLUG AND/OR VOLTAGE)
WIRE COLOR CODES:
BLACK or BROWN - HOT/ELECTRIFIED
WHITE or BLUE - "N" NEUTRAL/RETURN
GREEN or YELLOW GREEN - GROUND/EARTH



12) HOLE FOR STRAIN RELIEF SUPPORTING POWER CORD
13) NOZZLE (PC/ABS)
14) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) SLOT HEAD LEASH ANCHOR POINT BETWEEN FINS, UNDER EDGE

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Fan Diagram 100-EC, 100-EL



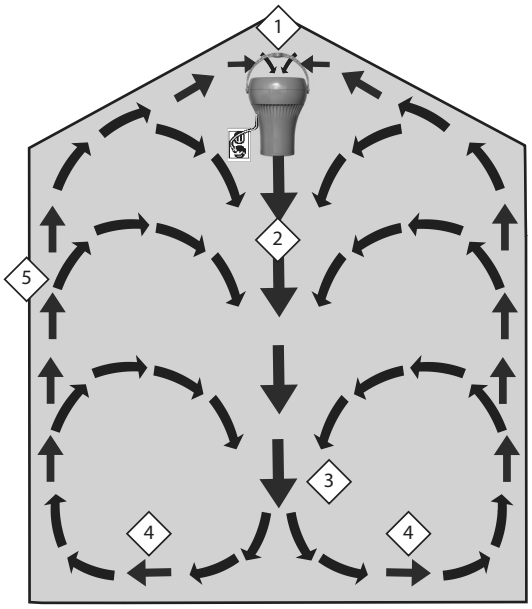
1) SUSPENSION CHAIN
2) 1/4 - 20 x 1
3) 1/4 x 7/8 WASHER
4) 3/16 x 1 7/8 QUICKLINK
5) STEEL GRILLE, PHOSPHATED, BLACK
6) MOTOR/IMPELLER
7) STATOR (ABS)
8) COWL (PC/ABS)
9) 3 WIRE 6 FT. 300 VAC RATED POWER CORD - 1 EA. (SPECIFY PLUG AND/OR VOLTAGE)
   WIRE COLOR CODES:
   BLACK or BROWN - HOT/ELECTRIFIED
   WHITE or BLUE - "N" NEUTRAL/RETURN
   GREEN or YELLOW GREEN - GROUND/EARTH



10) NOZZLE (PC/ABS)
11) HOLE FOR STRAIN RELIEF SUPPORTING POWER CORD
12) 10 - 32 x 3/4 T-25 TORX (1/8 HEX) PAN HEAD LEASH ANCHOR POINT BETWEEN FINS, UNDER EDGE
13) 1/4 - 20 x 4 T-30 TORX PAN HEAD (x4)
    #12 SAE FLAT WASHER (x4)

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Understanding Air Pear's Unique Air Flow



1. Low Velocity Intake - Low intake speed does not disturb air boundary layer under roof deck.
2. Columnar Laminar Flow - Removing the rotational component induced by the axial fan allows for the air to move in a straight, ductless column from the ceiling to the floor.
3. Entrainment - The column acts on the surrounding dead pool of air to induce entrainment and effectively multiply the air delivered to the floor.
4. Radial Spread - Once the column hits the floor, the air spreads radially until it loses velocity and migrates toward the ceiling.
5. Torus - The combination of these effects creates a torus-type air circulation and mixing pattern that effectively and efficiently achieves thermal equalization and general air movement.

Determine the number of fans, model and amperage to facilitate in the branch circuit design. Only qualified person(s) may determine the proper branch sizing and facilitate installation. If you have questions, contact your local electrical contractor.



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INSTALLATION

Power Requirements

Model Amperage 120VAC, single phase, 50/60 Hz:

Air Pear 10-SP: 0.11 / 0.13 A
Air Pear 15-SP: 0.11 / 0.14 A
Air Pear 25-SP: 0.30 / 0.32 A
Air Pear 45-P4: 0.40 / 0.41 A
Air Pear 45-P2: 1.05 / 1.48 A
Air Pear 60-P4: 0.91 / 0.92 A

Model Amperage 100-130VAC, single phase, 50/60 Hz:

Air Pear 10-EC: 0.12 A
Air Pear 15-EC: 0.17 A
Air Pear 25-EC: 0.4 A
Air Pear 45-EC: 2.2 A
Air Pear 45-EL: 2.2 A
Air Pear 60-EC: 2.2 A
Air Pear 60-EL: 2.2 A
Air Pear 100-EC: 4.2 A

Model Amperage 230VAC, single phase, 50/60 Hz:

Air Pear 10-SP: 0.06 / 0.06 A
Air Pear 15-SP: 0.06 / 0.07 A
Air Pear 25-SP: 0.14 / 0.13 A
Air Pear 45-P4: 0.19 / 0.2 A
Air Pear 45-P2: 0.54 / 0.7 A
Air Pear 60-P4: 0.57 / 0.66 A

Model Amperage 200-250VAC, single phase, 50/60 Hz:

Air Pear 10-EC: 0.06 A
Air Pear 15-EC: 0.08 A
Air Pear 25-EC: 0.26 A

Model Amperage 277VAC, single phase, 60 Hz:

Air Pear 25-SP: 0.14 A
Air Pear 45-P4: 0.2 A
Air Pear 45-P2: 0.7 A
Air Pear 60-P4: 0.68 A

Model Amperage 200-277VAC, single phase, 50/60 Hz:

Air Pear 45-EC: 1.4 A
Air Pear 45-EL: 1.4 A
Air Pear 60-EC: 1.3 A
Air Pear 60-EL: 1.3 A
Air Pear 100-EC: 2.5 A
Air Pear 100-EL: 2.5 A

Branch Circuit Protection

The Air Pear fans do not include fuses for branch circuit protection. The branch circuit must have a dedicated circuit breaker or similar device. National and local safety standards and electrical codes may determine additional requirements for installation.

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Plug Wiring (230/277VAC Models)

120VAC cord is supplied with a molded three-prong polarized/grounded plug. DO NOT DEFEAT this SAFETY DEVICE or modify the plug in any way.

230/277VAC no plug supplied. When fitting a plug always ensure that all relevant local regulations/electrical codes are understood and followed with care - if in any doubt seek expert guidance.

The power cord is a three-wire 18 AWG (or 16 AWG) 300VAC rated electrical cord UL rated in North America (NA) as SJT or for CE/EU compliance rated as HO5VV.

The three wires in the power cord are color-coded to ensure proper wiring as follows:

BLACK or BROWN = HOT/ELECTRIFIED/LIVE
WHITE or BLUE = “N” NEUTRAL/RETURN PATH
GREEN or YELLOW-GREEN = GROUND/EARTH

The cord is attached to the fan motor via two power leads with insulated 1/4” quick connects.

The cord is secured in the housing by a strain relief and knotted inside the housing for additional security.

Procedure for wiring the plug in a single-phase electrical system:

Use CAUTION when wiring/attaching the plug (Male Connector) to the Air Pear/Designer Series system or when using any electrical device.

1. Plug should be rated for 230VAC or 277VAC and fit properly into outlet (female connector) being used for power.

2. To avoid electrical shock, DO NOT plug device into energized outlet until all exposed wires and connecting terminals are enclosed by plug housing. See plug manufacturer’s instructions.

3. Locate the three stripped wires on the 300VAC rated power cord attached to the unit where the outer cord insulation jacket has been removed. Wires are coded as follows: black or brown is HOT/Live (the energized conductor), white or blue is neutral “N” (the conductor used for a return current path) and green or yellow/green is ground/earth (the conductor to connect to the earth).

4. Using the plug manufacturer’s instructions, locate the proper positions to attach the color-coded wire to the color-coded or otherwise appropriately labeled terminals on the plug.

5. Tighten all connections. Reassemble plug in accordance with plug manufacturer’s instructions.

To confirm electrical continuity, if possible, plug the Air Pear system into an energized outlet on the ground, similar to the outlet installed in the ceiling, before permanently mounting.

NOTE: The Air Pear System can be wired directly to a junction box but only by a qualified electrician or similarly qualified person. Always ensure that all relevant local regulations/electrical codes are understood and followed with care - if in any doubt seek expert guidance. Check local electrical codes. The preferred system is designed with a plug for easy service and cleaning. An on-off switch must be installed in the circuit to be able to disable the power to prevent electrical hazard when servicing the appliance.

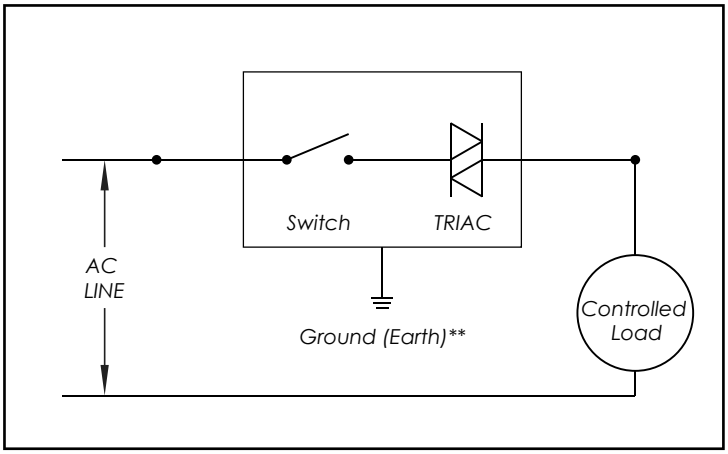
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Speed Control Wiring (Model 10-SP, 15-SP, 25-SP, 45-P2, 45-P4 & 60-P4)

SAFETY WARNING!

Unit should be installed by a qualified electrician in accordance with the National Electrical Code and other local codes that may apply. This control must be grounded when installed. Failure to follow these instructions may result in electrical shock or a fire hazard. This control is suitable for mounting in a metal or approved enclosure. These controls must not be used for loads exceeding those ratings clearly marked on the device.

CONNECTION DIAGRAM FOR 2-WIRE CONTROLS



APPLICATION

- Motor Type - Shaded Pole, PSC and Universal.
- Required Load - Fans and speed dependant loads.

WIRING

- Warning! - Power must be turned off before wiring. Connect control in series with motor and line voltage - never connect control across line.

MOUNTING

- Use 2” deep standard electrical box.
- Secure control with outer bracket tabs.

MINIMUM SPEED ADJUSTMENT

- Motor must be in actual operating conditions to achieve proper speed adjustment. (Motor will not slow down unless proper load is applied.)
- Turn main control knob clockwise to lowest speed position.
- Locate and adjust minimum speed setting on front plate with screw driver (rotate clockwise to decrease minimum speed; counter-clockwise to increase minimum speed.)
- Note: For all high-current models, 8 amps or greater, the opposite minimum speed rotation adjustment must be made so that motor runs with sufficient torque to prevent stalling.
- Motor will now operate from this preset minimum speed to full speed.

FINAL MOUNTING

- Install front dial plate - remove protective plastic.
- Turn main control until switch snaps off.
- Push on knob so that pointer is off position.

NOTE: For no switch models install front dial plate and push on knob.

TRIAC SIZING CONSIDERATIONS

- ** Some models do not require grounding. Therefore, a ground wire is not provided.
- Make sure the total circuit amperage load does not exceed the TRIAC’s rated amperage.
- Make sure TRIAC’s voltage rating matches line voltage.

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2-Speed Control Wiring (Model 10-EC, 15-EC and 25-EC only)

SAFETY WARNING!

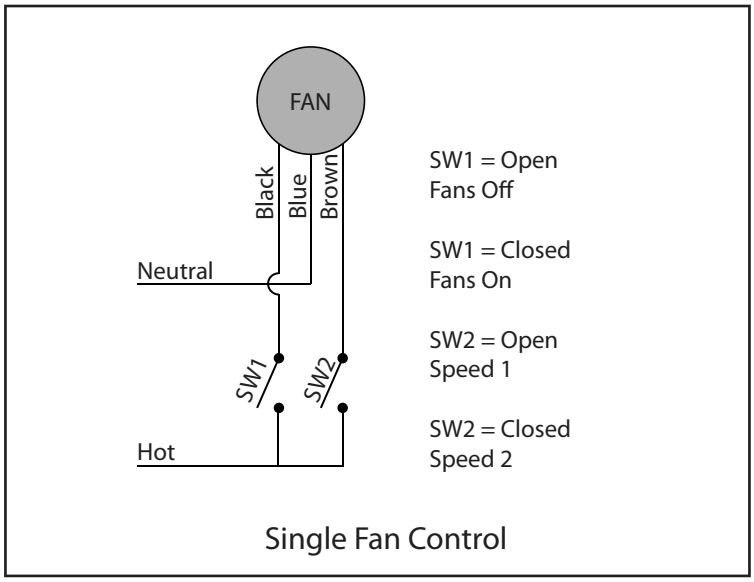
Unit should be installed by a qualified electrician in accordance with the National Electrical Code and other local codes that may apply.

APPLICATION

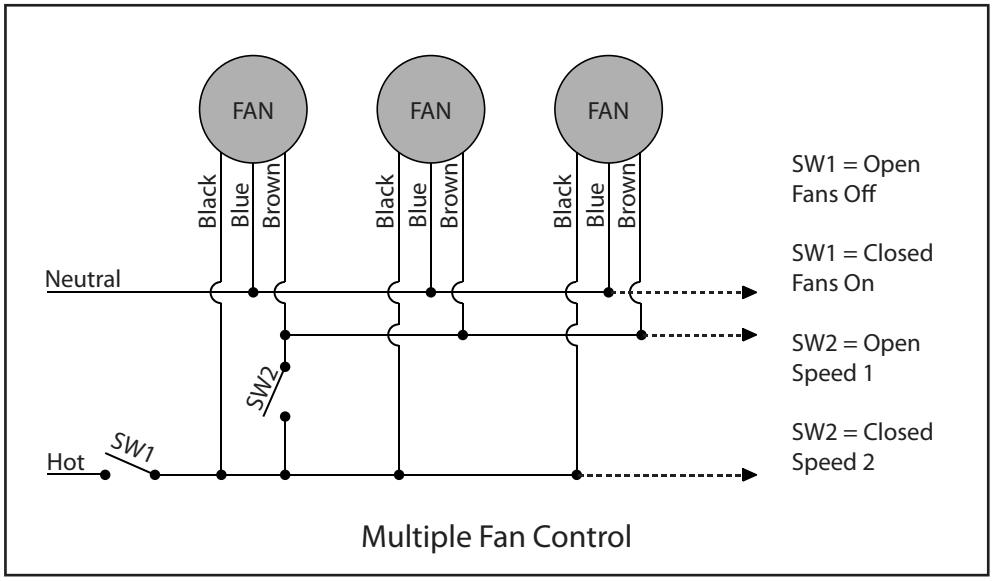
• Motor Type - Electronically Commutated, 2-speed control. The 2 speeds are factory set. Do not use this wiring method if you have the optional 0-10VDC control module or a shaded pole motor.

WIRING

• Warning! - Power must be turned off before wiring.



Single Fan Control



Multiple Fan Control

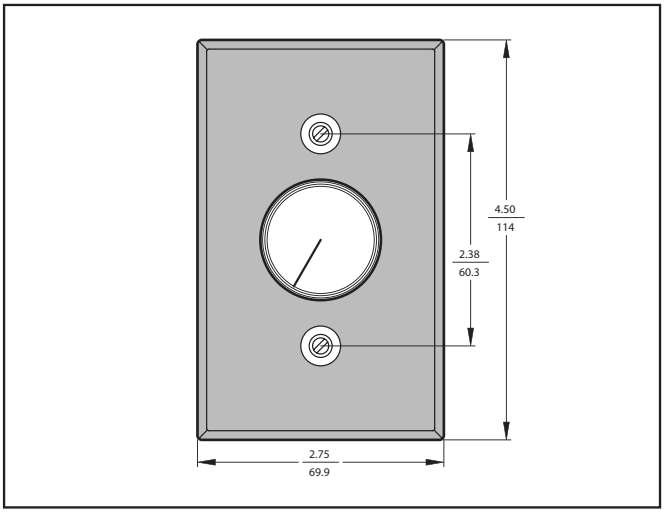
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Speed Control Wiring (10-EC, 15-EC & 25-EC with optional 0-10VDC module. Model 45-EC, 60-EC & 100-EC)

POTENTIOMETER SPEED CONTROL DESCRIPTION

Multi-turn wirewound potentiometer used to vary the speed of electrically commutated (EC) motors. Speed controls for shaded pole or PSC motors: refer to page 14. Speed control for EL fans: refer to seperate FanCenter installation & operation guide.

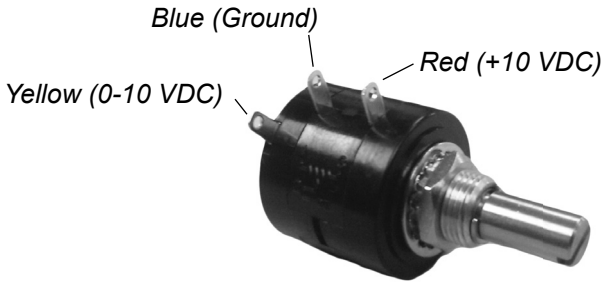
MODEL	VALUE (Ω)	LINEARITY	TOLERANCE
POT-1	10K	±0.25%	±5%

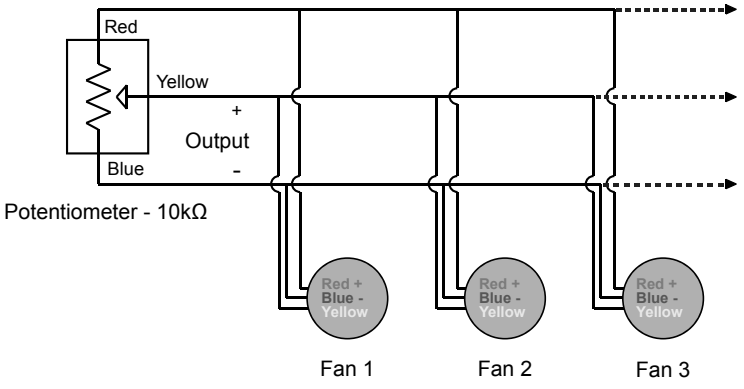


GENERAL NOTES

- The fan is supplied with current via the DC output and supplies a 0-10VDC signal that allows infinitely variable open loop speed control.
- If control wire exceeds 1300 ft. refer to Potentiometer wiring (external power source).
- A single controller can be used to control multiple fans with the same speed setting.
- Connecting the red and yellow leads will allow EC fans to operate at full speed.
- Wire runs up to 1000 feet (305 m) can be made using 20 - 24 AWG control wire. Wire runs longer than 1000 ft. will require the addition of a 10 - 12VDC power supply (not included).

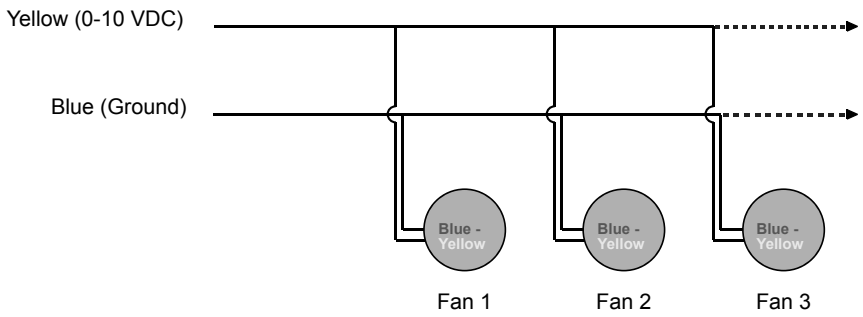
Potentiometer Control Wiring





BAS Control Wiring

The BAS should be capable of generating a 0-10VDC signal to modulate the fan speed. Use the following wiring diagram if this is the preffered connection type.



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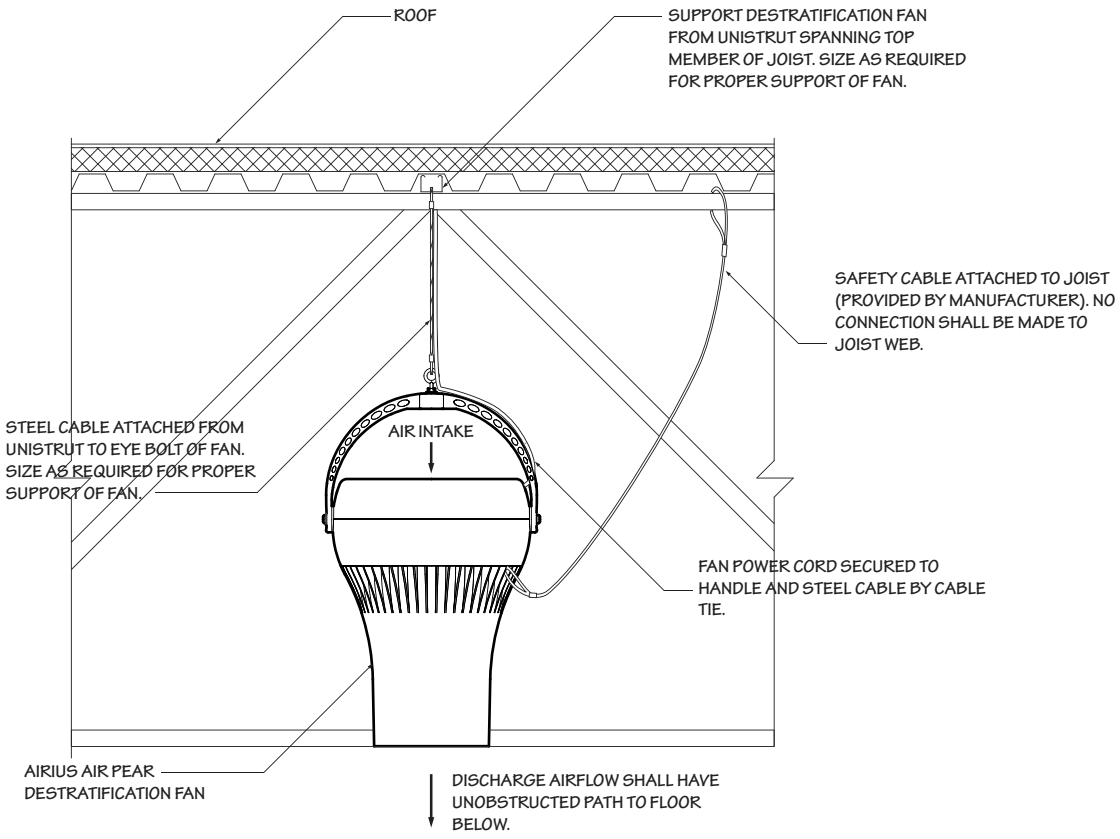
Free-Hanging Air Pear Suggested Installation Methods

Hardware that may be used to hang the unit includes, but is not restricted to: Hooks, chains, cables, carabiners, bridle rings, beam clamps and bolts. Roof structure, building construction and accessibility will define the appropriate hardware for each installation. Mount the fan as high in the ceiling as possible and do not restrict airflow into the intake.

After ensuring the Air Pear system is firmly attached and after REMOVING YOUR HANDS FROM THE UNIT, ONLY THEN is it safe to plug the unit into the power source using the approved plug to confirm function and electrical continuity.

NOTE: Secure the power cord to the ceiling structure as added security. The cord will act as a safety leash and by securing it the possibility of the plug accidentally coming out of the outlet is greatly reduced. A 50 lb. (20 kg.) rated Zip Tie or several wraps of mechanics wire are examples of methods of securing the power cord.

The following graphic is an example of hanging the typical Air Pear unit:



DESTRATIFICATION FAN DETAIL

SCALE: NONE

NOTES:

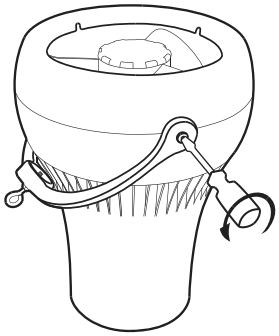
1. INSTALL FAN AS CLOSE AS POSSIBLE TO CEILING. (TYP 0'-6" TO 2'-0")
2. OPTIONAL HANGING METHODS INCLUDE: BEAM CLAMP/BRIDLE RING, CHAIN LINK/CARABINER, THREADED ROD/LOCK NUTS, ETC...
3. CONTRACTOR TO PROVIDE POWER FEED IN CONDUIT. THE ELECTRICAL CONNECTION CAN BE MADE IN A J-BOX (HARD WIRED) OR PLUG CONNECTION (J-BOX/RECEPTACLE).

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Suggested Installation Methods

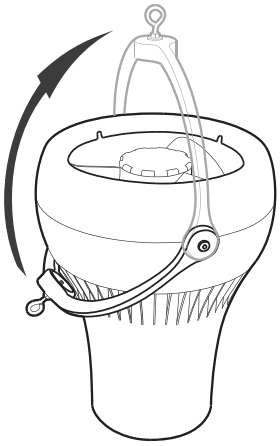
1

Remove the Air Pear from its box, then remove the plastic protective bag. The bail (handle) is attached via two Torx screws. Using T-30 Torx driver, loosen these screws enough so the bail may swing.



2

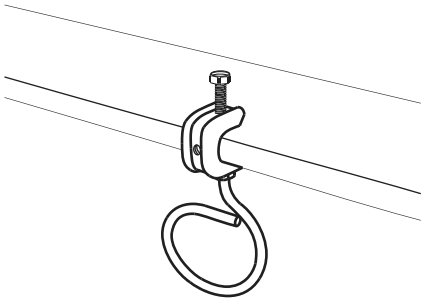
Swing the bail to the vertical position and re-tighten the two Torx screws.



3

The Air Pear system is designed to hang vertically and freely 12-to-18 inches, or as close as possible, from the ceiling on professionally installed hardware, for models 10/15/25, capable of supporting a minimum of five times the weight of the Air Pear unit, 60 lb. (27 kg.). Example - 1/4” (7 mm) diameter steel bolt is rated at 60 lb. (27 kg.) load.

A feature of the Air Pear system is its flexibility. Hardware that may be used to hang the unit includes, but is not restricted to: Hooks, chains, cables, carabiners, bridle rings, beam clamps and bolts. Roof structure, building construction and accessibility will define the appropriate hardware for each installation.

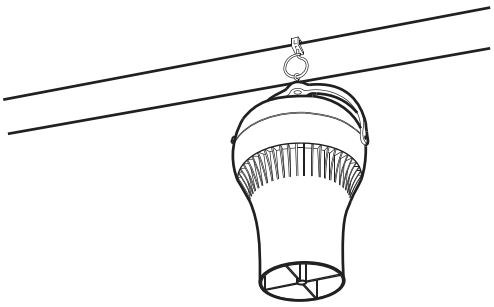


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Suggested Installation Methods

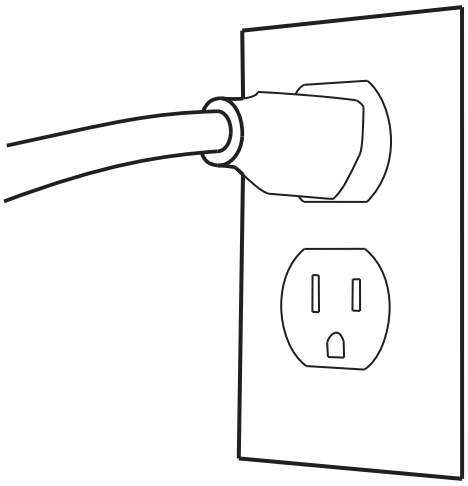
4

After ensuring the Air Pear system is firmly attached, remove your hands from the unit.



5

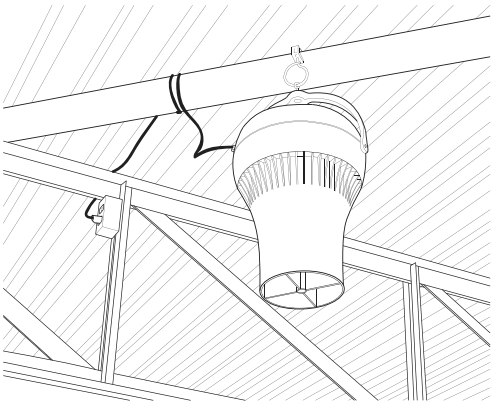
It is then safe to plug the unit into the power source using the approved plug to confirm function and electrical continuity.



6

NOTE: SECURE the power cord to the ceiling structure as added security. The cord will act as a safety leash and by securing it the possibility of the plug accidentally coming out of the outlet in the future is greatly reduced. A 50 lb. (20 kg.) rated Zip-Tie or mechanics wire are examples of methods of securing the power cord.

The graphic to the right is an example of hanging the Air Pear unit:



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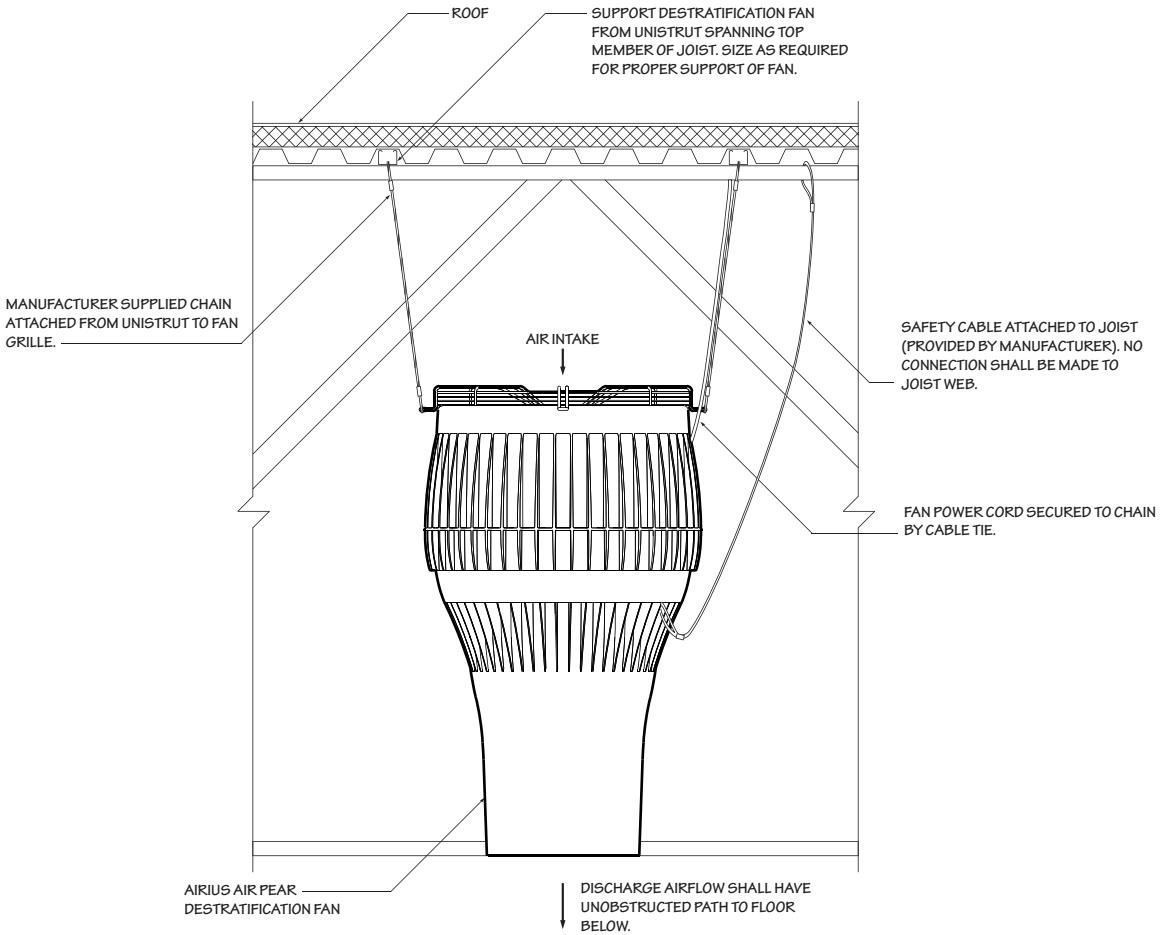
Free-Hanging Air Pear 100 Suggested Installation Method

200 lbs rated chains are supplied with the Model 100 fans that attach to the unit and the structure above. Roof structure, building construction and accessibility will define the appropriate connection hardware for each installation. Do not fasten units to joist web members or joist bridging.

After ensuring the Air Pear system is firmly attached and after REMOVING YOUR HANDS FROM THE UNIT, ONLY THEN is it safe to plug the unit into the power source using the approved plug to confirm function and electrical continuity.

NOTE: Secure the power cord to the ceiling structure as added security. The cord will act as a safety leash and by securing it the possibility of the plug accidentally coming out of the outlet is greatly reduced. A 50 lb. (20 kg.) rated Zip Tie or several wraps of mechanics wire are examples of methods of securing the power cord.

The following graphic is an example of hanging the Air Pear Model 100:



DESTRATIFICATION FAN DETAIL

SCALE: NONE

NOTES:
1. INSTALL FAN CLOSE TO CEILING. (TYP 1'-6" TO 3'-0")
2. CONTRACTOR TO PROVIDE POWER FEED IN CONDUIT. THE ELECTRICAL CONNECTION CAN BE MADE IN A J-BOX (HARD WIRED) OR PLUG CONNECTION (J-BOX/RECEPTACLE).
3. THE THIRD MANUFACTURER SUPPLIED CHAIN CAN BE USED TO TILT THE FAN AT AN ANGLE.

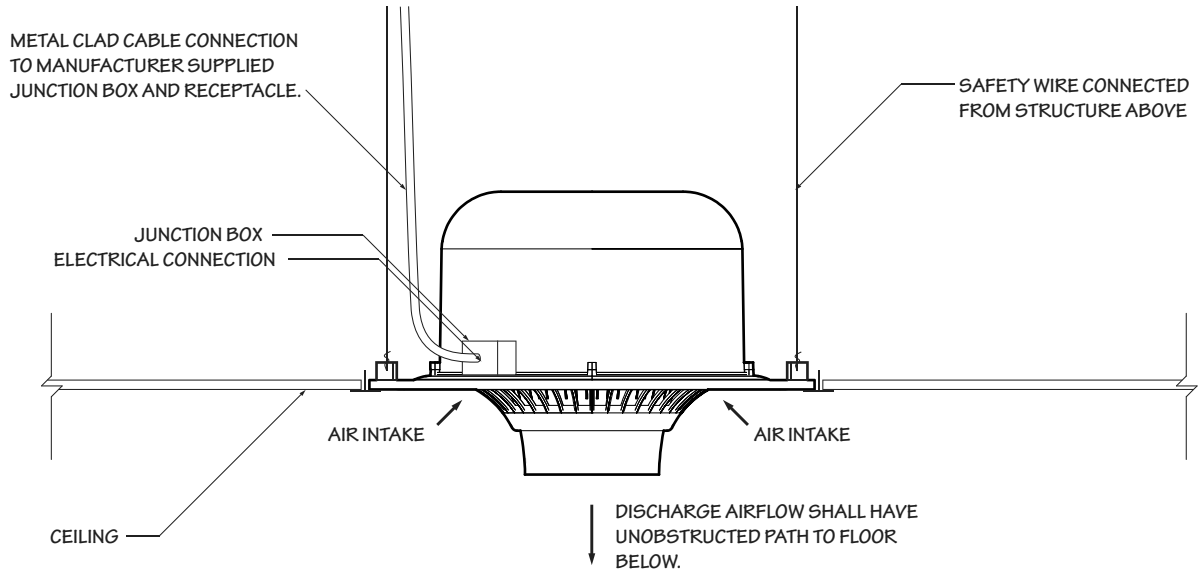
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Suspended Ceiling Air Pear Suggested Installation Methods

After ensuring the Air Pear system is firmly attached and after REMOVING YOUR HANDS FROM THE UNIT, ONLY THEN is it safe to plug the unit into the power source using the approved plug to confirm function and electrical continuity.

NOTE: Drill each of the four right angle corner tabs and secure the faceplate to the structure above with mechanics wire.

The following graphic is an example of hanging the typical Suspended Ceiling Air Pear unit:



DESTRATIFICATION FAN DETAIL

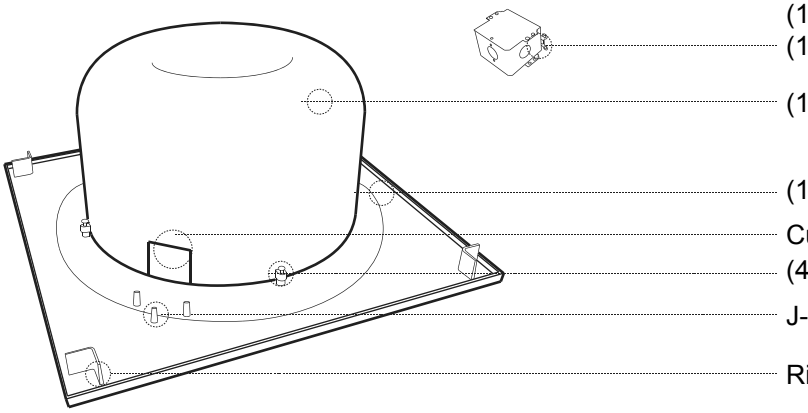
SCALE: NONE

NOTES:

1. CONTRACTOR SHALL INSTALL METAL CLAD CABLE TO MANUFACTURER SUPPLIED JUNCTION BOX AND RECEPTACLE.

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Suspended Ceiling Air Pear Assembly & Installation

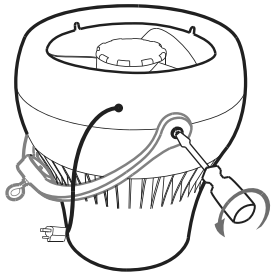


(1) J-box and (1) Faceplate
(1) 120V, 230V or 277V Receptacle, (2) Thumb Screws*
(1) Dome
(1) Air Intake Grille
Cutout for Power Cord/Receptacle
(4) Phillips Screws*
J-box Mounting Location
Right Angle Tabs

*Included in hardware bag

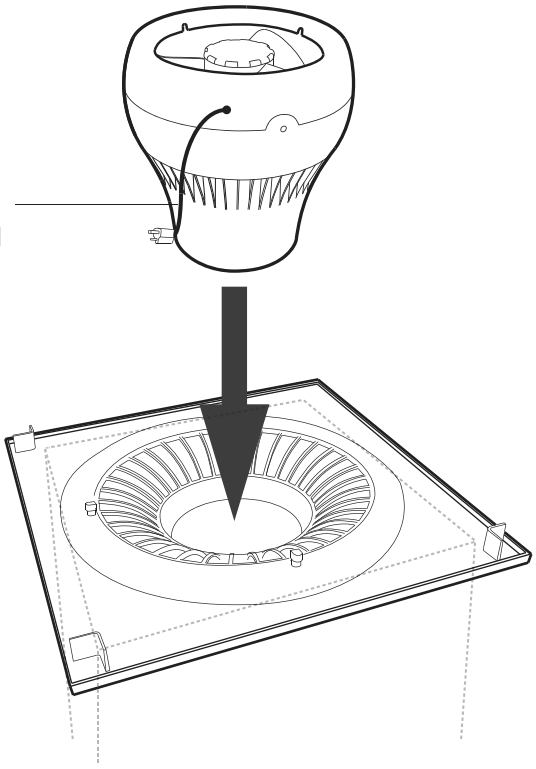
1

Remove the Air Pear from its box and plastic protective bag. The bail (handle) is attached via two Torx screws. Loosen these screws and remove the bail (discard at your discretion).



2

Remove all components from packing materials. Using the box that the suspended ceiling kit unit arrived in, open end up, place the 2’ x 2’ flat air intake grille over the open end of the box, face down. The right angle corner tabs should be facing up. Insert the Air Pear unit (with bail removed) into the center hole so that the nozzle extends below the air intake grille and the cord is hanging over the edge.



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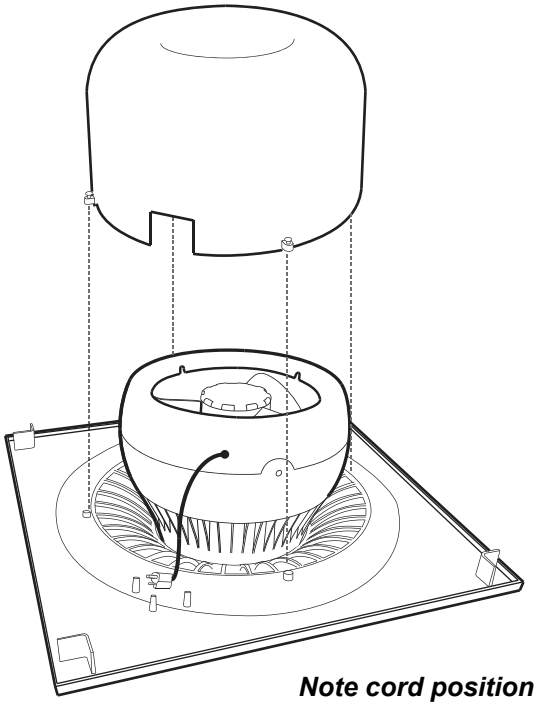
Suspended Ceiling Kit Assembly & Installation (cont.)

3

Place dome over Air Pear unit and align it with screw holes. Note that cutout should face the j-box mounting location. Dome should seat into the rim designed for it on the base, if necessary gently push the dome edge in until it seats inboard of the rim.

Insert the four Phillips screws (10-32 x 5/8” provided) through ears in dome and into threaded brass inserts. Screws will go in easily when aligned properly. Do not overtighten, as galling or stripping could occur.

When dome is installed, the power cord needs to be fed through the cutout in the dome.



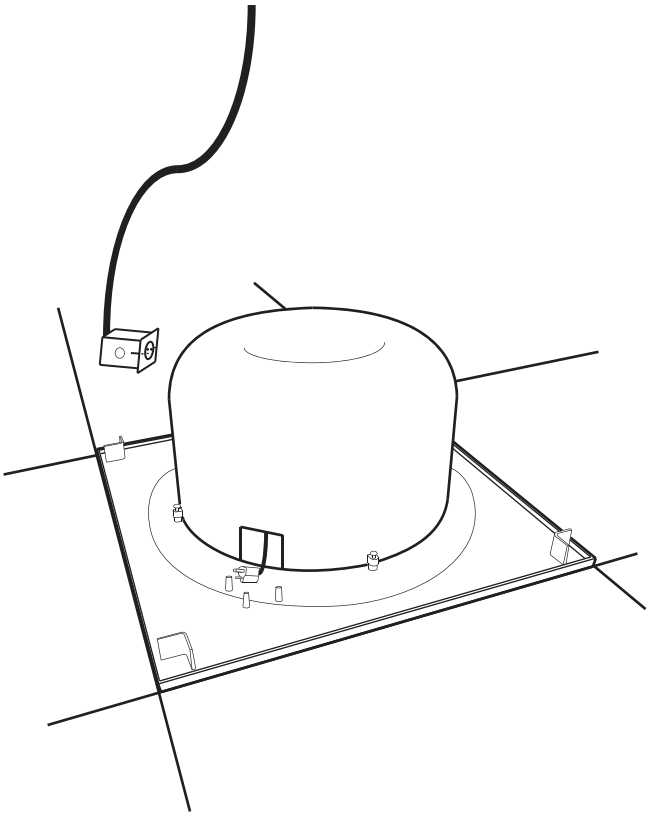
Note cord position

4

Have an electrician or similarly qualified person wire, with MC-type cable, the supplied receptacle into the j-box in close proximity to the intended installation location. Fasten the supplied metal faceplate to the j-box. Follow all local and national electric codes. MC cable should have enough length to ensure easy installation.

5

Place the assembled suspended ceiling kit into the T-bar grid. The air intake grille is designed to replace a 2’ x 2’ ceiling tile. If replacing a 2’ x 4’ tile, please use an additional piece of 2 ft. T-bar suspension material to finish the edge and provide additional strength and rigidity to the existing suspension system.

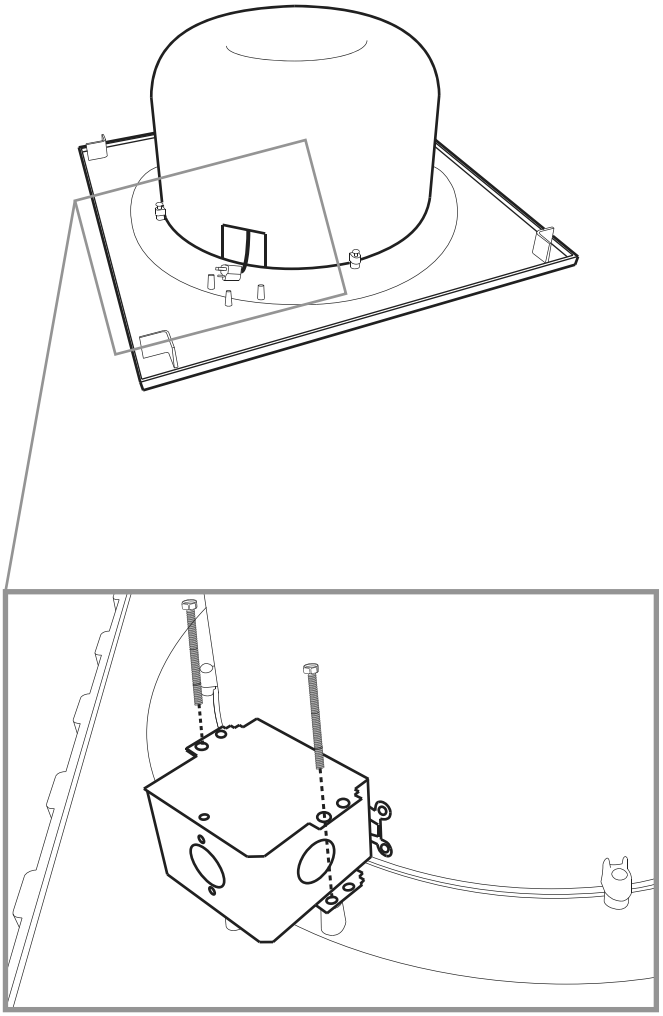


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Suspended Ceiling Air Pear Assembly & Installation (cont.)

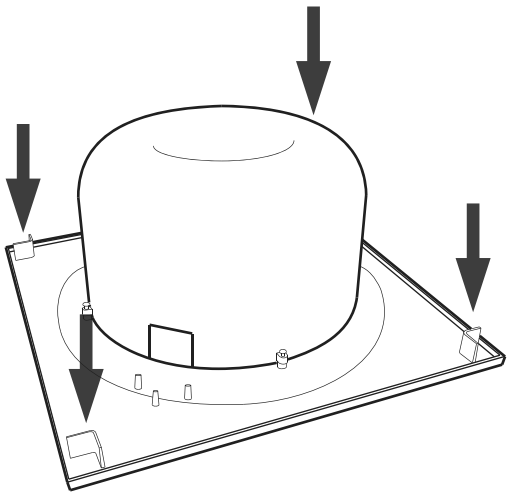
6

Plug the Air Pear power cord into the receptacle. Using the supplied thumbscrews, fasten the j-box to the air intake grill through the indicated holes as shown (wiring to j-box omitted for clarity).



7

The base has four right angle tabs located at each corner that can be drilled for additional ceiling/support wires to be added if desired.



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OPERATING THE FAN

Heating Season

Within an enclosed building space, with minimal air movement, hot lighter air rises to the ceiling while cold heavier air falls to the floor creating a temperature gradient. This condition will cause excess energy use as the HVAC system fights to maintain the thermostat set point typically at 5 ft. above floor level. This inefficient condition can also cause great thermal discomfort for the building occupants.

The Air Pear is an energy-efficient air turbine, designed to continuously move a column of air to the floor. A typical Air Pear installation includes a series of units mounted just below the ceiling, evenly spaced throughout a facility, working in concert to balance the air temperature ceiling to floor and wall to wall.

As air circulation improves and air temperatures balance, your HVAC system will require less and less energy to comfortably heat the work area, reducing the energy consumption of HVAC systems up to 35% or more. Once started, the entire process of “thermal equalization” will take, on average, less than 24 hours.

All Air Pear fans are designed to run continuously, year-round, to maintain thermal equalization and general air movement.

Cooling Season

We tend to think stratification occurs only in the heating season, but actually the condition exists year round. As you mechanically condition the air to combat rising outdoor temperatures, combined with minimal air movement, a large temperature gradient can exist.

The HVAC system will consume more energy as it fights the temperature gradient, hot and cold spots and short cycling compared to a properly mixed space. Using the Air Pear system will help alleviate the problem through thermal equalization. Keeping the thermostats satisfied longer and creating air movement that produces a cooling effect on the skin will result in the ability to raise the thermostat set points as much as 6° F, yielding up to an 18% energy savings during cooling seasons.

In non-air conditioned spaces, the Air Pear system can be used for spot cooling and general air circulation. If a large temperature differential exists between day and night, a strategy of drawing cool night air into the space and closing openings during the day can help maintain a cooler temperature internally as outdoor air temperatures rise.

A person’s head is most sensitive to comfort perception. Hot air trapped in the ceiling warms all the surrounding duct work, decking and other ceiling-mounted equipment to act as a radiant heat source and can cause the occupants to perceive discomfort. Reducing this radiant heat source through thermal equalization will help alleviate this condition.

All Air Pear fans are designed to run continuously, year-round, to maintain thermal equalization and general air movement. The fan speed can be maintained the same throughout the year or increased for the summer months to enhance the evaporative cooling effect if people in the space find this to be desirable.

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MAINTENANCE

Preventive Maintenance

Follow these easy steps to prevent any excess dirt buildup and preserve the life of the product:

No lubrication is required as bearings are sealed.

Cleaning:

- **Unplug unit from power source** first to prevent possible electrical shock and prevent injuries from spinning blades.
- Caution: Stationary blades can cause injury!
- You may clean the plastic housing with a damp cloth, using mild household detergent only.
- DO NOT use petroleum products, thinners, solvents, ammonia, alcohols or other chemicals to clean any part of the Air Pear unit.

Note: If fan is not operating or any parts are broken, contact manufacturer for replacement information.

TROUBLESHOOTING

General Troubleshooting

The Air Pear/Designer Series units are tested before they leave the factory, resulting in an extremely low rate of returns. However, mechanical devices do fail, and we recommend that you identify the problem and try the simple suggestions below.

Fan will not start:

a) Check fuses and circuit breakers.
b) Check voltage at fan connection.
c) Adjust the trim set screw in fan wall speed control (if using optional speed control). If minimum setting is too low the fan may shut off with voltage fluctuations. Increase minimum. See page 14 for more information.
d) Contact manufacturer for additional help: 1-888-AIR-PEAR (888-247-7327).

Fan airflow is too fast/slow:

a) Adjust speed control dial to produce desired flow. Adjust the trim set screw in fan wall speed control (if using optional speed control). If minimum setting is too low the fan may shut off with voltage fluctuations. Increase minimum. See page 14 for more information.

Fan has excess vibration (noise or wobbles):

a) Make certain the hanging hardware is secured tightly.
b) Contact manufacturer for additional help: 1-888-AIR-PEAR (888-247-7327).

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WARRANTY

Airius Warranty Policy

This warranty is limited to products purchased directly from Airius, LLC ("Airius") or one of its authorized resellers. To determine whether a reseller is authorized, please contact Airius at the contact information below.

Airius warrants products listed below will operate properly and be free of defects in materials and workmanship according to the following terms:

Products	Warranty Period
Air Pear Fans	3 Years (All Parts/Components)
Designer Series Fans	3 Years (All Parts/Components)
Retail Series Fans	3 Years (All Parts/Components)
Speed Controllers	1 Year (All Parts/Components)
Photohydroionization Cell	2 Years (All Parts/Components)

These include new units or units rebuilt under Airius' factory refurbish program. Airius will repair or replace such units, at Airius' sole discretion, if there is any defect in their materials or workmanship caused by Airius during the warranty period. With respect to replacement or repair rendered, Airius warrants that the parts replaced or repaired will operate properly and be free from defects in materials and workmanship for the remainder of the original warranty period.

Definitions:

1. The "warranty period" shall begin on the shipping date from the Airius factory to the customer (end user)
2. "Operate properly" applies to mechanical, electrical and structural functions only. No guarantee is made regarding the quantity of air movement or the appropriateness or the effectiveness or merchantability of any product for its intended purpose or for the customer's particular application.

Exclusions

Any of the following actions will constitute a breach of and will void all warranties:

1. Improper delivery, installation, or maintenance, including, but not limited to:
   a. Failure to follow the required installation procedures specified in the Airius "Installation Guide" and in all other documentation supplied with the fans and related equipment, including documentation provided by the manufacturers of the individual fan and control components;
   b. Failure to follow all applicable codes and ordinances, including, but not limited to the National Electric Code and state and local building codes;
   c. Failure to follow electrical engineering industry standards regarding the approved method of installing electrical equipment having the characteristics of the fans, the fan controls, and their related components, even if such standards are not explicitly referenced in any literature supplied by Airius or provided by the manufacturers of the fan and control components.
2. Any modification or alteration of, or adjustment to the fans, fan controls, and/or any disassembly of the components of the fans and fan controls for any purpose whatsoever, including any attempt to diagnose and/or repair any problem, without prior written authorization from Airius. Such disassembly includes, but is not limited to, separation of the motor from the housing assembly and/or removal of any electrical component from the fan controller unit.
3. Installation of fans into a detrimental environment with airborne oils / cutting fluids / solvents that may attack the base resin or motor, unless:
   a. Airius has provided written authorization prior to installation.
4. Misuse, abuse, accidents, unreasonable use or Acts of God.
5. Incorrect electric current, voltage or supply.
6. Failure to use fan controls supplied by Airius, unless:
   a. Airius has provided written authorization prior to installation; and
   b. The fan controls are built, operated and maintained according to specifications provided to and approved by Airius.

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Airius Warranty Policy (Continued)

7. Failure to perform periodic maintenance as detailed in the Airius-supplied "Installation Guide."
8. Consequential or incidental damages sustained by any person or entity as a result of any breach of these warranties are also excluded, except where such damages may not be excluded by law.

Acquiring Warranty Service

Do not return any item without first being assigned a Return Material Authorization (RMA) tag number. Customer must obtain a RMA# from Airius (888-AIR-PEAR or info@theairpear.com) before returning the faulty unit. RMA number must appear on the return-shipping label and be associated with any correspondence. Customer is responsible for all return shipping costs to:

Airius Warranty - RMA# ____
811 South Sherman Street
Longmont, Colorado 80501

Airius will return the unit(s) freight prepaid. Airius may elect to repair the same unit at customer site or offer replacement parts to facilitate repair and reduce customer down time and expense. Airius is not responsible for misuse of their product. Freight claims are the responsibility of the customer and all products are shipped FOB Longmont, Colorado, USA.

Remedy and Limit of Liability

The exclusive remedy of the purchaser, and the limit of liability for Airius, for any and all losses in connection with this product shall be repair or replacement of the warranted product or the affected components, as provided above.

Airius reserves the right to make the final determination, based on its own assessment, as to (1) whether the problem in question is the result of a defect in design, workmanship or materials, and not the result of error, misuse or abuse on the part of the customer, as set forth under the exclusions detailed above; (2) whether the problem or defect is material and requires action under this warranty; and (3) whether the remedy of repair or replacement is appropriate.

With regard to electrical and electronic components provided by Airius that comprise part of the products, including motors, Airius relies on the determination by the original manufacturer as to whether the failure of such component was the result of a defect. If the manufacturer of such component determines that there was no defect and therefore refuses to cover it under warranty, Airius likewise will not warranty such item.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY, REPRESENTATION OR CONDITION OF MERCHANTABILITY OR THAT THE PRODUCTS ARE FIT FOR ANY PARTICULAR PURPOSE OR USE, AND SPECIFICALLY IN LIEU OF ALL SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. REPAIR OR REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF AIRIUS FOR ANY SPECIAL, INDIRECT, INCIDENTIAL, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED, TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE.

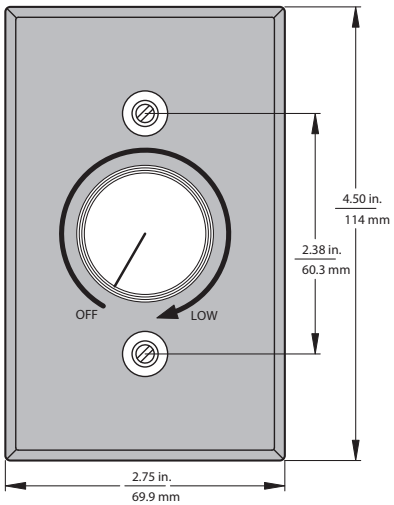
Any and all disputes related to this warranty or any other matter related to Airius must be submitted to binding arbitration within 45 radial miles of Longmont, Colorado. The arbitrator will follow the Colorado Uniform Arbitration Act and the Rules of the American Arbitration Association. Under Colorado law, punitive damages are not recoverable by any party subject to arbitration. Moreover, jury trials are not available in arbitration. The arbitration decision or award is legally binding and enforceable. To the extent that a court rules that this paragraph is not enforceable, the parties agree to resolve any and all disputes in the Boulder District Court in Boulder, Colorado.

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TRIAC-120-5 SPEED CONTROL SUBMITTAL

CONTROL OF SINGLE OR MULTIPLE SHADED POLE/PSC MOTOR

MODEL	VOLTAGE	AMPS
TRIAC-120-5	120V	5



PROJECT	
ENGINEER	
ARCHITECT	
CONTRACTOR	
SUBMITTED BY	
DATE	
QUANTITY	

PART NUMBER & QUANTITY

☐ TRIAC-120-5 Qty. _____

Note: Expect the fan to hum at the lower to middle speed where the sine-wave chopping is most severe. Fan control works best when fully loaded

TRIAC SPEED CONTROL DESCRIPTION

Airius speed controls are used to vary the speed of shaded pole (SP) or permanent split capacitor (PSC) motors. Speed controls for EC motors: refer to the potentiometer submittal. Speed control for EL fans: refer to the FanCenter submittal.

ATTRIBUTES AND CHARACTERISTICS

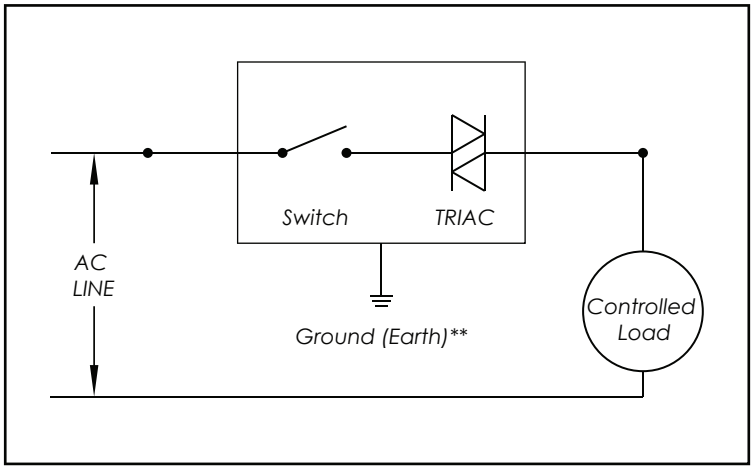
- *Built-in On/Off AC line switch*
- *Minimum speed trimpot*
- *RFI filter (provides RFI and EMI suppression)*
- *All models mount in a standard 2" x 4" electrical wall box*
- *Faceplate (4.5" x 2.75"), knob, screws and wire nuts included*
- *Simple installation by a qualified electrician*
- *Adjust top 50% RPM*
- *Can control multiple fans on a single dedicated circuit*

CODE APPROVAL

- *UL listing/recognition*
- *CSA certified*

WARRANTY

- *Warranty - 1 - years parts and workmanship*



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811 South Sherman Street, Longmont, Colorado 80501, Phone: 303.772.2633, Fax: 303.772.8276, info@airiusfans.com, www.airiusfans.com

May be covered by one or more of the following United States Patents: 7,381,129 B2; D514688 and other patents pending

Commercial Gas Water Heaters

CYCLONE® Mxi MODULATING

MODULATING BURNER ADVANCES THE CYCLONE TO HIGHER LEVELS OF EFFICIENCY

The full line of A. O. Smith Cyclone Mxi condensing water heaters has been designed to provide years of dependable service and feature industry leading technology. Models are available from 120,000 to 500,000 Btu/h and all deliver thermal efficiencies of 95% and higher. The unique helical coil heat exchanger limits weld joints for optimal service life while maximizing heat transfer.

Cyclone is the industry leader in high efficiency commercial water heating. The current Mxi modulating models adjust firing rate to the specific demand further increasing efficiency and money savings.

INTELLIGENT CONTROL SYSTEM WITH LCD DISPLAY AND iCOMM CONNECTIVITY

- Exclusive A. O. Smith designed touch display control system
- Provides detailed water heater status information
- Precise temperature control adjustable from 90 to 180 degrees
- Built-in diagnostics
- Run history information
- Cyclone® Mxi Modulating water heaters are compatible with the iCOMM™ remote monitoring system. Call 1.888.928.3702 for information.

COMING SPRING 2017

- Remote monitoring capability utilizing the iCOMM app. Wi-Fi connectivity kit requited for models 120-250, standard on models 300-500.

SUBMERGED COMBUSTION CHAMBER, WITH HELICAL HEAT EXCHANGER COIL

- Positioned in center of tank, surrounded by water to virtually eliminate radiant heat loss from chamber
- Direct spark ignition
- Spiral heat exchanger keeps hot burner gases swirling, uses centrifugal force to maximize efficiency of heat transfer to water in tank
- Spiral heat exchanger reduces lime scale from forming on water-side surfaces, which maintains energy efficiency over time

POWERED ANODES STANDARD ON ALL MODELS

- Provides long-lasting tank protection in varying water conditions
- Powered anodes are non-sacrificial
- Automatically adjusts output needed to properly protect the tank

PERMAGLAS® ULTRA COAT™ GLASS LINING

- Glass coating is applied using a liquid slush coating technique to ensure uniform coating
- Heat exchanger coil is glassed both externally and internally for optimum protection

MECHANICAL VENTING VERSATILITY

- Conventional power venting or direct venting
- Vents vertically or through a sidewall
- Front located exhaust and condensate connections allow for easy install and access
- Vents with low cost PVC Schedule 40 intake and exhaust pipe. Approved for optional CPVC Schedule 40, Polypropylene and AL29-4C stainless steel vent materials
- Direct-vent intake and exhaust pipe can terminate separately outside building or through single opening, using concentric vent assembly
- Canadian installations require ULC S636 PVC/ CPVC, ULC S636 Polypropylene and AL29-4C stainless steel pipe for intake and exhaust

HIGH EFFICIENCY MODULATING PRE-MIX POWERED BURNER

- Down-fired pre-mix burner provides optimum efficiency and quiet operation
- Top-mounted burner position prevents condensation from affecting burner operation

3-YEAR LIMITED TANK / 1-YEAR LIMITED PARTS WARRANTY

- For complete warranty information, consult written warranty or go to hotwater.com.



BTH-120(A) THROUGH BTH-500(A)
MODEL SHOWN:
BTH-199(A) SERIES 300/301

Low Lead Content · ENERGY STAR · CERTIFIED WATER QUALITY · ASME HLW · GAS-FIRED c UL us LISTED · iCOMM · AHRI CERTIFIED www.ahridirectory.org · ASME (Optional)

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www.hotwater.com | 800-527-1953 Toll-Free USA | A. O. Smith Corporation | 500 Tennessee Waltz Parkway | Ashland City, TN 37015

OTHER FEATURES:

SPACE-SAVING DESIGN FOR INSTALLATION FLEXIBILITY

- Easy-to-remove top cover for convenient access to serviceable parts
- 0″ installation clearances on sides and rear, 1-1/2″ installation clearance on top
- Handhole cleanout allows easy access to tank interior for cleaning
- 0″ clearance to combustibles, approved for installation on combustible floors

CODES AND STANDARDS

- CSA certified and ASME rated T&P relief valve
- Maximum hydrostatic working pressure: 160 psi
- All models are design certified by Underwriters Laboratories (UL), Inc., to ANSI Z21.10.3 - CSA 4.3 Standards
- Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IES 90.1
- Design Certified by Underwriters Laboratories to NSF standard 5 for 180°F (62°C) water
- Complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for ultra low-NOx emissions
- ASME tank construction optional on 120-500 model sizes

VENT REQUIREMENTS FOR BTH 120(A) - 250(A)

Number of 90° Elbows Installed	3 Inch Pipe	4 Inch Pipe
	Maximum Feet (Meters)	Maximum Feet (Meters)
One (1)	45 feet (13.7 meters)	115 feet (35 meters)
Two (2)	40 feet (12.2 meters)	110 feet (33.5 meters)
Three (3)	35 feet (10.7 meters)	105 feet (32 meters)
Four (4)	30 feet (9.1 meters)	100 feet (30.5 meters)
Five (5)	N/A	95 feet (29 meters)
Six (6)	N/A	90 feet (27.4 meters)

VENT REQUIREMENTS FOR BTH 300(A) - 500(A)

Number of 90° Elbows Installed	4 Inch Pipe	6 Inch Pipe
	Maximum Feet (Meters)	Maximum Feet (Meters)
One (1)	65 feet (19.8 meters)	115 feet (35 meters)
Two (2)	60 feet (18.2 meters)	110 feet (33.5 meters)
Three (3)	55 feet (16.8 meters)	105 feet (32 meters)
Four (4)	50 feet (15.2 meters)	100 feet (30.5 meters)
Five (5)	45 feet (13.7 meters)	95 feet (29 meters)
Six (6)	40 feet (12.2 meters)	90 feet (27.4 meters)

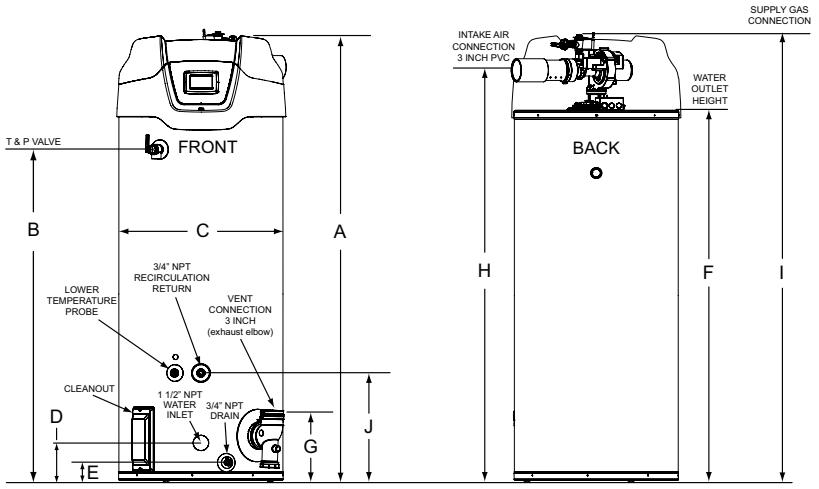
GAS PRESSURE REQUIREMENTS

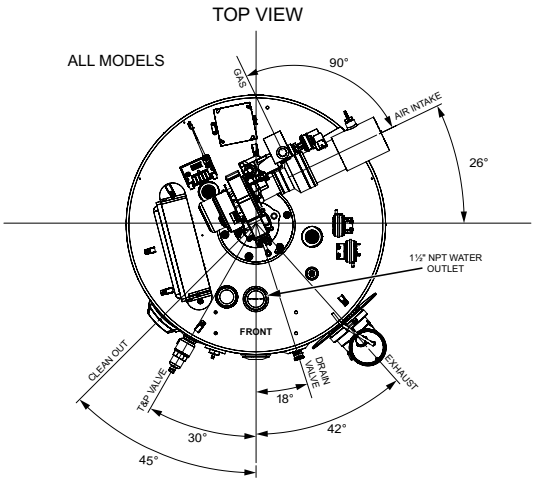
Model Number	Manifold Pressure		Minimum Supply Pressure		Maximum Supply Pressure	
	Natural Gas	Propane Gas	Natural Gas	Propane Gas	Natural Gas	Propane Gas
BTH-120(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	3.5"W.C. (1.10 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-150(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	3.5"W.C. (1.10 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-199(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	3.5"W.C. (1.10 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-250(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	3.5"W.C. (1.10 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-300(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	4.8"W.C. (1.19 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-400(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	4.8"W.C. (1.19 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)
BTH-500(A)	0"W.C. (0 kPa)	0"W.C. (0 kPa)	4.8"W.C. (1.19 kPa)	8.5"W.C. (2.12 kPa)	14"W.C. (3.49 kPa)	14"W.C. (3.49 kPa)

Depending on the installed equivalent length, and/or the number of appliances connected, the supply gas line size may need to be increased beyond the minimum required size.

Commercial Gas Water Heaters

BTH 120-250





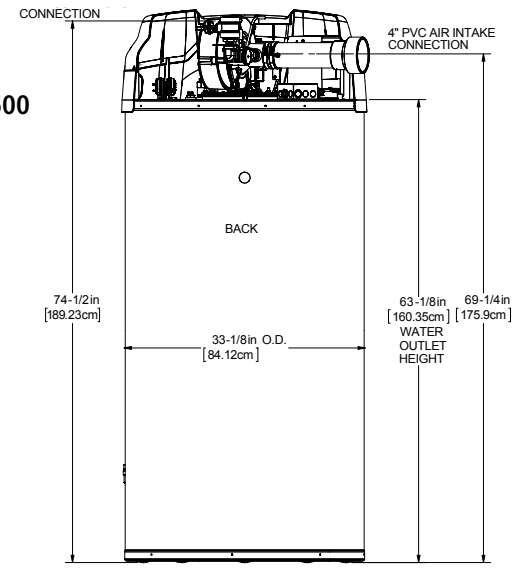
* Center line of water outlet on top of the water heaters is approximately 7 inches from the front edge of the water heater

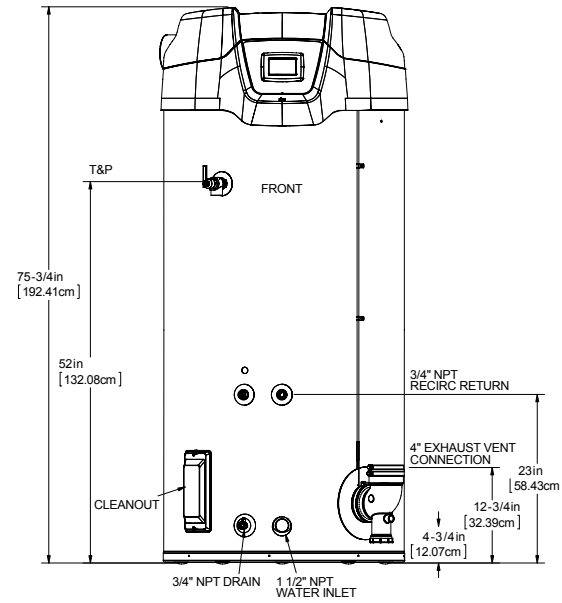
Model Number	Approx. Capacity		Dimensions										lb/kg	Approx. Shipping Weight Std	Approx. Shipping Weight ASME
			A	B	C	D	E	F	G	H	I	J			
BTH-120(A)	Gallons	60	55 1/2	35	27 3/4	6 5/16	3	42 1/4	11 1/4	48 1/2	53 1/2	18 1/4	lb	460	490
	Liters	227	141	88.9	70.5	16	7.62	107.32	28.6	123.2	135.9	46.36	kg	208	220
BTH-150(A)	Gallons	100	76 1/2	56 3/8	27 3/4	6 5/16	3	64	11 1/4	70	75 1/2	18 1/4	lb	523	553
	Liters	379	194.9	143.2	70.5	16	7.62	162.6	28.6	177.8	191.8	46.36	kg	237	251
BTH-199(A)	Gallons	100	76 1/2	56 3/8	27 3/4	6 5/16	3	64	11 1/4	70	75 1/2	18 1/4	lb	523	553
	Liters	379	194.9	143.2	70.5	16	7.62	162.6	28.6	177.8	191.8	46.36	kg	237	251
BTH-250(A)	Gallons	100	76 1/2	56 3/8	27 3/4	6 5/16	3	64	11 1/4	70	75 1/2	18 1/4	lb	523	553
	Liters	379	194.9	143.2	70.5	16	7.62	162.6	28.6	177.8	191.8	46.36	kg	237	251

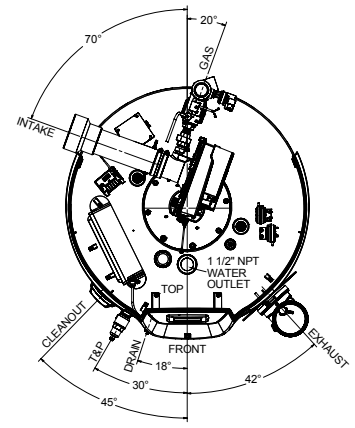
Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

Commercial Gas Water Heaters

BTH 300-500







Model Number	Approx. Capacity		Dimensions										lb/kg	Approx. Shipping Weight Std	Approx. Shipping Weight ASME
			A	B	C	D	E	F	G	H	I	J			
BTH-300(A)	Gallons	119	75 3/4	52	33 1/8	4 3/4	4 3/4	63 1/8	12 3/4	69 1/4	74 1/2	23	lb	855	855
	Liters	450.96	192.41	132.08	84.12	12.07	12.07	160.35	32.39	175.9	189.23	58.43	kg	387	387
BTH-400(A)	Gallons	119	75 3/4	52	33 1/8	4 3/4	4 3/4	63 1/8	12 3/4	69 1/4	74 1/2	23	lb	855	855
	Liters	450.96	192.41	132.08	84.12	12.07	12.07	160.35	32.39	175.9	189.23	58.43	kg	387	387
BTH-500(A)	Gallons	119	75 3/4	52	33 1/8	4 3/4	4 3/4	63 1/8	12 3/4	69 1/4	74 1/2	23	lb	855	855
	Liters	450.96	192.41	132.08	84.12	12.07	12.07	160.35	32.39	175.9	189.23	58.43	kg	387	387

Electrical characteristics-120V-60Hz A.C., 5.0 A
"A" in model represents ASME construction
Propane gas models available
Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

Commercial Gas Water Heaters

RECOVERY CAPACITY

Model Number	Type of Gas	Input		Thermal Efficiency
		BTU/HR	kW	
BTH-120(A)	Natural/Propane	120,000	35	95%
BTH-150(A)	Natural/Propane	150,000	44	98%
BTH-199(A)	Natural/Propane	199,900	58	97%
BTH-250(A)	Natural/Propane	250,000	73	96%
BTH-300(A)	Natural/Propane	300,000	88	96%
BTH-400(A)	Natural/Propane	399,900	117	95%
BTH-500(A)	Natural/Propane	499,900	146	95%

Model Number	U.S. GALLONS/HR AND LITRES/HR AT TEMPERATURE RISE INDICTATED													
	Approx. Capacity	°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F	130°F	140°F
		°C	17°C	22°C	28°C	33°C	39°C	44°C	50°C	56°C	61°C	67°C	72°C	78°C
BTH-120(A)	60 U.S. Gals.	GPH	461	345	276	230	197	173	154	138	126	115	106	99
	227 Litres	LPH	1743	1308	1046	872	747	654	581	523	475	436	402	374
BTH-150(A)	100 U.S. Gals.	GPH	594	445	356	297	255	223	198	178	162	148	137	127
	379 Litres	LPH	2248	1686	1349	1124	963	843	749	674	613	562	519	482
BTH-199(A)	100 U.S. Gals.	GPH	783	588	470	392	336	294	261	235	214	196	181	168
	379 Litres	LPH	2965	2224	1779	1483	1271	1112	988	890	809	741	684	635
BTH-250(A)	100 U.S. Gals.	GPH	970	727	582	485	416	364	323	291	264	242	224	208
	379 Litres	LPH	3670	2753	2202	1835	1573	1376	1223	1101	1001	918	847	786
BTH-300(A)	119 U.S. Gals.	GPH	1164	873	698	582	499	436	388	349	317	291	269	249
	450.96 Litres	LPH	4405	3304	2643	2202	1888	1652	1468	1321	1201	1101	1017	944
BTH-400(A)	119 U.S. Gals.	GPH	1535	1151	921	767	658	576	512	460	419	384	354	329
	450.96 Litres	LPH	5810	4358	3486	2905	2490	2179	1937	1743	1585	1453	1341	1245
BTH-500(A)	119 U.S. Gals.	GPH	1919	1439	1151	959	822	720	640	576	523	480	443	411
	450.96 Litres	LPH	7263	5448	4358	3632	3113	2724	2421	2179	1981	1816	1676	1556

Recovery capacities are based on AHRI rated thermal efficiencies.
For ASME Construction add an "A" to the end of the model number ex: BTH-120A.

STORAGE CAPACITY

Model Number	U.S. Gallons	Liters
BTH 120	60	227
BTH 150	100	379
BTH 199	100	379
BTH 250	100	379
BTH 300	119	450.96
BTH 400	119	450.96
BTH 500	119	450.96

GAS LINE CONNECTION SIZE

Model	Series	Natural Gas	Propane Gas
BTH 120	300/301	3/4" NPT	3/4" NPT
BTH 150	300/301	3/4" NPT	3/4" NPT
BTH 199	300/301	3/4" NPT	3/4" NPT
BTH 250	300/301	3/4" NPT	3/4" NPT
BTH 300	300/301	1-1/2" NPT	1-1/2" NPT
BTH 400	300/301	1-1/2" NPT	1-1/2" NPT
BTH 500	300/301	1-1/2" NPT	1-1/2" NPT

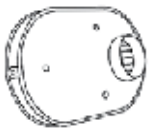
Commercial Gas Water Heaters

OPTIONAL KITS



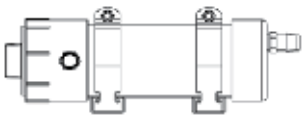
OPTIONAL CONCENTRIC VENT KITS

- BTH-120 - 250 vent kit p/n 100111100
- BTH-300 - 500 vent kit p/n 100113124



OPTIONAL LOW PROFILE TERMINATION VENT KITS

- 3˝ Flush Mount Vent Kit p/n 100187887
- 4˝ Flush Mount Vent Kit p/n 100187888
- 6˝ Flush Mount Vent Kit p/n 100187889



OPTIONAL CONDENSATE NEUTRALIZATION KITS

- BTH-120-199 kit p/n 100112380
- BTH-250-500 kit p/n 100112381

COMMON VENTING KITS FOR UP TO 3 WATER HEATERS (ONE KIT PER WATER HEATER REQUIRED)

Kit	Description
100227396	PVC Common Vent Kit, 120 – 250 Models
100223775	PVC Common Vent Kit, 300 – 500 Models
100227395	Polypropylene Common Vent Kit, 120 -250 Models
100223774	Polypropylene Common Vent Kit, 300 - 500 Models

Installations must comply with all national, state and local codes.
See kit instructions and corresponding water heater manual for detailed installation instructions and additional information.
50 Feet maximum equivalent length of straight pipe common vent and elbows
NOTE: Order 1 kit for each water heater.
See the Common Vent Kit manual or spec sheet for detailed information.

SPECIFICATION

(Natural or Propane) gas water heater(s) shall be A. O. Smith Cyclone Mxi model # _____ or equal, minimum 95% thermal efficiency, a storage capacity of _____ gallons, an input rating of _____ BTUs per hour, a recovery rating of _____ gallons per hour (gph) at 100°F rise and a maximum hydrostatic working pressure of 160 psi. Water heater(s) shall: 1. Modulating gas burner that automatically adjusts the input based on demand. 2. Powered anodes that are non sacrificial and maintenance free. 3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded; 4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1; 5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve; 6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 7. Be approved for 0˝ clearance to combustibles.

The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. 1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters; 2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

120K-250K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for power venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (3˝ or 4˝) _____ diameter PVC pipe for a total distance of (50 ft or 120 ft.) _____ equivalent feet of vent piping and (50 ft. or 120 ft.)_____ equivalent feet of intake air piping.

300K - 500K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for standard power venting using a (4˝ or 6˝)_____ diameter PVC pipe for a total distance of (70 ft. or 120 ft.)_____ equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (4˝ or 6˝) _____ diameter PVC pipe for a total distance of (70 ft or 120 ft.) _____ equivalent feet of vent piping and (70 ft. or 120 ft.)_____ equivalent feet of intake air piping.

Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

Water heater should incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert.

For Technical Information, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.

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POWERMITE® GAS BOOSTER HEATER

INSTALLATION, OPERATING, SERVICE AND PARTS MANUAL

MODEL: PMG-100 & PMG-200

I&W #07.05.055.00

WATER HEATERS FOR OTHER THAN RECREATIONAL VEHICLE INSTALLATION ONLY

CHAUFFE-EAU POUR INSTALLATION AUTRE QUE DANS DES VÉHICULES DE LOISIR UNIQUEMENT

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**
- **WHAT TO DO IF YOU SMELL GAS:**
  - **Do not try to light any appliance.**
  - **Do not touch any electrical switch; do not use any phone in your building.**
  - **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
  - **If you cannot reach your gas supplier, call the fire department.**
- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

AVERTISSEMENT: Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort.

- **Ne pas entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.**
- **QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:**
  - **Ne pas tenter d'allumer d'appareil.**
  - **Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.**
  - **Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.**
  - **Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.**
- **L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.**

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IMPORTANT OWNER INFORMATION

Record the model number, serial number (identification plate located on the lower right hand side, front corner of the unit), voltage and purchase date of your Powermite® Gas Booster Heater in the spaces below. Please have this information available when calling Hatco for service assistance.

Model No. _____

Serial No. _____

Voltage _____

Date of Purchase _____

Business Hours: 8:00 a.m. to 5:00 p.m. Central Standard Time

(Summer Hours: June to September – 8:00 a.m. to 5:00 p.m. C.D.T. Monday through Thursday 8:00 a.m. to 2:30 p.m. C.D.T. Friday)

Telephone: (800) 558-0607; (414) 671-6350

Fax: (800) 690-2966 (Parts & Service)
(414) 671-3976 (International)

24/7 24-Hour 7-Day Parts & Service Assistance available in the United States and Canada by calling (800) 558-0607.

Additional information can be found by visiting our web site at **www.hatcocorp.com**.

INTRODUCTION

Hatco Powermite Gas Booster Heaters are instantaneous fin tube type heaters designed to boost the temperature of regularly available hot water, usually 110°F to 150°F (43°C to 66°C) up to 180°F (82°C). Water at 180°F (82°C) can be used as sanitizing rinse water in commercial dishwashers in accordance with Health Codes and National Sanitation Foundation Standard #5.

The Hatco Gas Booster Heater is design certified by CSA International and tested under the requirements of the American National Standard, **ANS Z21.10.3*CSA 4.3-2001, Current Edition**.

All Hatco Gas Booster Heaters are factory pre-plumbed and pre-wired to allow for easy installation. The control compartment area is accessible from the front, which permits easy installation, even when near other equipment.

Hatco Gas Booster Heaters are quality built for long life and rugged dependability. Dependability of the booster heater is preserved through proper, safe installation and operation.

This manual provides the installation, safety and operating instructions for the Powermite Gas Booster Heater. We recommend all installation, operating and safety instructions appearing in this manual be read prior to installation or operation of your Hatco PMG-100 or PMG-200 Gas Booster Heater. Safety instructions that appear in this manual after a warning symbol ⚠ and the words **WARNING** or **CAUTION** printed in bold face are very important. ⚠ **WARNING** means there is the possibility of serious injury or death to yourself or others. ⚠ **CAUTION** means there is the possibility of minor or moderate injury. **CAUTION** *without the symbol* signifies the possibility of equipment or property damage only.

Hatco Gas Booster Heaters are a product of extensive research and field testing. The materials used were selected for maximum durability, attractive appearance and optimum performance. Every unit is thoroughly inspected and tested prior to shipment.

MODEL DESCRIPTION

ALL MODELS

Water enters the booster heater at the inlet water connection and flows into the stainless steel tank. It then is pumped through the finned tube heat exchanger where it is heated to the proper temperature. The heated water then returns back to the top half of the stainless steel tank for supply to the dishwashing machine. Water that is not immediately used by the dishwashing machine is recirculated through the heat exchanger by the water pump.

This system is designed to assure the availability of the proper temperature water at the heater outlet.

All Hatco booster heaters are warranted to be free of defects in material and workmanship under normal use and service, and when installed in accordance with factory recommendations.

NOTE: Hatco Booster Water Heaters are approved for use with commercial dishwashers only.

SYSTEM OVERVIEW

The Hatco Powermite Gas Booster Heater is designed to maintain a temperature of 180°F (82°C) water required for the rinse cycle of a commercial dishwasher. An inlet water temperature of at least 110°F (43°C) will produce optimum results (See Capacity Chart and Booster Heater Sizing Chart in *SPECIFICATIONS*).

After the necessary power, water and gas connections are completed, start the unit by turning on the toggle switch located on the lower front base. The water circulating pump will start at this time. Providing the operating and safety controls are satisfied, the ignition module will begin a 20 second safety pre purge, next it will energize the spark igniter and turn on the gas for the pilot. The igniter will spark for about 90 seconds or until proof of fire. If there is a confirmed pilot fire, and the water temperature is below the setpoint, the unit will go into full burn. The unit will stay in full burn until the desired setpoint temperature is met, then the burner will shut off. During standby periods of limited use, the burner will cycle on only to replace standby water temperature loss. If for some reason the unit did not ignite there is an automatic 5 minute delay before the unit attempts to ignite again.

If the unit overheats above the setpoint temperature, the safety high limit will open, shutting down the burner, locking out the controller, and turning on the alarm pilot light. In order to reset the unit, turn the unit off and depress the reset button on the appropriate high limit switch, the tank high limit is located behind front panel on the left hand side of the vertical control panel. The heat exchanger high limit is located on the front of the heat exchanger. The switches will not reset until the temperature has dropped to a safe level. This unit must remain off for at least 10 seconds before it can be restarted.

NOTE: The operating thermostat control is factory preset at 190°F (88°C).

NOTE: The circulator pump will stay on as long as the toggle switch is in the ON position.

SPECIFICATIONS

Type: Gas-fired, instantaneous recirculating booster heater with accumulator for use with door type dishwashers. Unit is floor mounted.

Capacity: PMG-100: Input 105,000 BTUs/Hour. Output 84,800 BTUs/Hour = 24.8 kW
PMG-200: Input 195,000 BTUs/Hour. Output 156,000 BTUs/Hour = 45.7 kW

Fuel: Natural gas @ 5 iwc or Propane @ 11 iwc – minimum inlet gas pressure.

Operating Water Pressure: 150 PSI max. Relief valve set at 150 PSI, 210°F (99°C).

Power: Supply 120 VAC, 15 amp service (unit uses 3.0 amps @ 120 volts).

Ignition: Electronic spark pilot with flame proofing by rectification.

Temperature Control: Electronic, temperature control probe/microprocessor based. Factory preset at 190°F (88°C).

Safety Systems: Energy cut off devices include manual reset heat exchanger high limit and manually reset tank high limit. Redundant gas solenoid valve with integral regulator. Temperature/Pressure relief valve on tank.

Fluing: Direct – combustion air enters bottom, flue gases exit right side or back at top of unit.

Vent: Forced draft system with 4" (102 mm) diameter vent pipe adapter.

Pump: Recirculating with bronze housing.

Connections: Gas – 3/4" NPT, Water – 3/4" NPT, Electric – 120 VAC, 15 Amp.

Ship Weight: PMG-100: 155 pounds (70 kg) dry.
PMG-200 195 pounds (89 kg) dry.

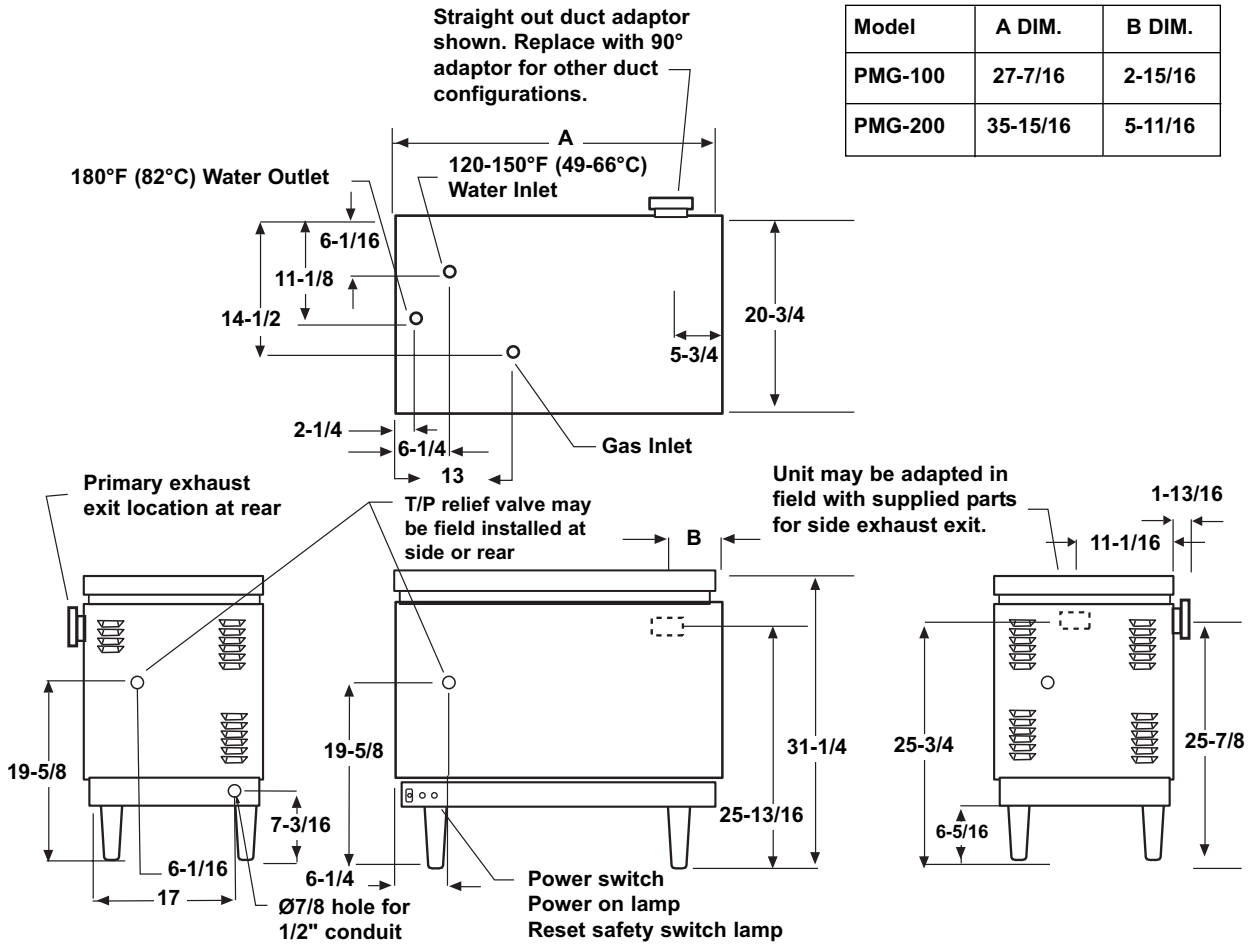
WATER TEMPERATURE RECOVERY TABLE - FAHRENHEIT

MODEL	INPUT MBH (1,000 BTU/HR)	Gallons per Hour (GPH) at Indicated Temperature Rise (F°)				
		30°	40°	50°	60°	70°
PMG-100	**105**	321	241	193	161	138
PMG-200	**195**	602	452	361	301	258

NOTE: Capacity is reduced @ altitudes above 2000 feet (610 m). See HIGH ALTITUDE INSTALLATION & OPERATION *section for sizing considerations.*

DIMENSIONS

Model	A DIM.	B DIM.
PMG-100	27-7/16	2-15/16
PMG-200	35-15/16	5-11/16



NOTE: Dimensions listed are in inches.

NOTE: Overall Dimensions PMG 100: 27-1/2" W x 20-3/4" D x 31" H (699 x 527 x 787 mm)
PMG 200: 36" W x 20-3/4" D x 31" H (914 x 527 x 787 x mm)

Figure 1. Top View

SPECIFICATIONS

BOOSTER HEATER SIZING CHART

Dishwasher	Model Number	GAS POWERMITE® BOOSTER† Temperature Rise 40°F (22°C)	70°F (39°C)
ADAMATION	CSL-1390, CA-2, CA-3, CA-4, SLAP 44, CA, CA-1	PMG-200	(2)PMG-200
BLAKESLEE	Series "R & "F"-CC, -EE, -LL, -MM, -LLL, -MMM, -PCC, -PEE, -PLL, -PMM (multi-tank) with suffix "LC"	PMG-200	PMG-200/100
	Series XF-LL, XF-PLL, XF-MM, XF-PMM, XF-EEE, XF-LLL, XF-MMM, (Multi-tank) with suffix "LC"	PMG-200	---
	DD-8	PMG-100	PMG-200
	Series R-L, R-PL, R-M, R-PM, F-L, F-PL, F-M, F-PM (single tank)	PMG-200	(2)PMG-200
	Series XF-PEE, XF-PLL, XF-PMM, XF-EEE, XF-LLL, XF-MMM (multi-tank)	PMG-200	(2)PMG-200
	FA (Flight-A-Round) and RA (Rack-A-Round) use comparable "F" listing.		
CHAMPION	D-H1C, D-H1TC	---	PMG-100
	66 WSPW, 44-WS, 66-WS	---	PMG-100
	UC-CW6-WS, US-CW8-WS	PMG-100	PMG-200
	44, 66 PW, 70FFPW, 80HDPW, 54, 76PW, 80FFPW,90HDPW 64, 90FFPW, 100HDPW, 86 PW	PMG-100	PMG-200
	40-KB, 40-KB-2-2, 40-KFWB, 40-KPRB, 40-KPRB-2-2, 40KPRB-2-3, 60-KB, 60-KB-2-2, 60-KFWB, 60-KFWB-2-2, 60-KPRB, 60-KPRB-2-3, 64KB, 64-KB Corner, 64-KPRB, 64-KPRB Corner, 64 Modular, 86 Modular	PMG-200	PMG-200/100
	44-KB, 44-KB Corner, 44-KPRB, 44-KPRB Corner, 54-KB, 54-KB Corner, 54-KPRB, 54-KPRB Corner, 44 Modular, 66 PW Modular, UC** Series 6' Center, UC-C4	PMG-200	PMG-200/100
	UC-CW4, UC-C	PMG-200	PMG-200/100
	UC**CW Series 6' Center	PMG-200	(2)PMG-200
	W-6-WS	PMG-200	(2)PMG-200
CMA DISHMACHINES	CMA-44H with tank heater, CMA-66H	PMG-100	PMG-200
HOBART	AM-12, AM-12C*, AM-14, AM-14C	---	PMG-100
	Opti-RinSe C44A, CRS-66A, CCS-66A, CPW-80A, C54A, CRS-76A, CCS-76A, CPW-90A, C64A, CRS-86A, CCS-86A, CPW-100A, C-88A, CRS-110A, CCS-110A, CPW-124A	PMG-100	PMG-200
	C-54A, CRS-76A, CPW-90A, CCS-76A	PMG-200	PMG-200/100
	C-44A, CRS-66A, CCS-66A, CPW-80A, C-64A, CRS-86A, CCS-86A, CPW-100A	PMG-200	PMG-200/100
	C-88A, CRS-110A, CPW-124A, CCS-110A	PMG-200	PMG-200/100
	Opti-RinSe C44AW, CRS-66AW, CCS-66AW, CPW-80AW	---	PMG-100
	C-44AW, CRS-66AW, CPW-80AW, CCS-66AW	PMG-100	PMG-100
	C-44, CRS-66, CPW-80	PMG-200	PMG-200/100
	C-54, CRS-76, CPW-90	PMG-200/100	(2)PMG-200
	C-64W, CRS-86W, CPW-100W, C-88W, CRS-100W, CPW-124W, CCS-86W	PMG-100	PMG-200
	C-64, CRS-86, CPW-100C	PMG-200	PMG-200/100
	FT800W, FT-900W	PMG-200	PMG-200
	FT-600, FT-700	PMG-200/100	(2)PMG-200
	FT800	PMG-200	(2)PMG-200
	FT-900, FT800S, FT-900S	PMG-200	PMG-200/100
	FRC and FR (Fast Rack Series) use comparable "C" line listing.		

BOOSTER HEATER SIZING CHART (CONTINUED)

Dishwasher	Model Number	GAS POWERMITE® BOOSTER† Temperature Rise	
		40°F (22°C)	70°F (39°C)
INSINGER	Commander 18-5, 18-5H, Ensign 40-2	---	PMG-100
	Admiral 44-4, 66-4	PMG-100	PMG-200
	Speeder 64, 86-3, Century (all)	PMG-100	PMG-200
	Trac 321, Trac 321-2/RPW	PMG-100	PMG-200
	Trac 878	PMG-100	PMG-200
	Clipper (all), R106-2, Super 106-2	PMG-100	PMG-200
	Defender	PMG-200	---
	Master (all)	PMG-200	---
	CA-3	PMG-200	---
	For outdated models, consult factory for correct booster.		
JACKSON	44CE*, 66 CERPW	PMG-200	---
	54CE, 76 CERPW	PMG-200	---
	64CE, 86 CERPW	PMG-200	---
	100	PMG-100	---
	150	---	PMG-100
	AJ-44, AJ-66, AJ-80, WH-44, ES-4400, ES-6600 (ECOLAB/JACKSON)	PMG-100	PMG-200
	AJ-54, AJ-76, AJ-90	PMG-200	---
	AJ-64, AJ-86, AJ-100	PMG-100	PMG-200
	*Model #44CE w/SN1999 or below requires larger booster than listed.		
MEIKO	K-44, K-66, K-80	PMG-100	PMG-200
	K-54, K-76, K-90, K-64, K-86, K-100	PMG-100	PMG-200
METALWASH/INTEDGE			
	FW4	---	PMG-100

SPECIFICATIONS

BOOSTER HEATER SIZING CHART (CONTINUED)

Dishwasher	Model Number	GAS POWERMITE® BOOSTER† Temperature Rise	
		40°F (22°C)	70°F (39°C)
STERO	SCT-44-10-LW, SCT-44-LW, SCT-66S-LW, SCT-76S-LW, SCT-90S-LW	---	PMG-100
	SC-1-2-4-LW, SC 1-6-4-LW, SC-2-4-LW, SC-5-2-4-LW, SC-5-6-4-LW, SC-6-4-LW	PMG-100	PMG-200
	SCT-64, SCT-86S, SCT-94S, SCT-94SC	PMG-100	PMG-200
	SCT-108S, SCT-108SC, SCT-76, SCT-94SM	PMG-200	PMG-200/100
	SC-6-4, SCT-44, SCT-44-10, SCT-66S, SCT-76S, SCT-76SC, SCT-90S	PMG-200	PMG-200/100
	SCT-120S, SCT-120SC, SCT-120SM, SCT-150SM	PMG-200	PMG-200/100
	STW-110, SC-1-2-7-4, SC-1-6-3-4, SC-1-6-7-4, SC-2-7-4, SC-5-2-7-4, SC-5-6-3-4, SC-5-6-7-4, SC-6-3-4, SC-6-7-4	PMG-200	PMG-200/100
	SC-1-2-4, SC-1-6-4, SC-2-4, SC-5-2-4, SC-5-6-4	PMG-200	(2)PMG-200
	SCT-44-10-SC-1-3-4, SCT-44-10-3-4, SCT-44-SC-1-3-4, SCT-44-SC-3-4, SCT-54-SC-1-3-4, SCT-54-SC-3-4, SCT-76S-SC-3-4	PMG-200	(2)PMG-200
	STPC (Four Tank)	PMG-100	PMG-200
	STPCW (Four tank)	PMG-100	PMG-200
	STPC	PMG-200	PMG-200/100
	STPCW	PMG-200	PMG-200/100
	SCBT	PMG-200	PMG-200/100
	SF-2RA, SF-2DRA, SD-2RA, SDRA, SDRA-PACK	---	PMG-100
	SCT-54, SCT-76SM	PMG-200	(2)PMG-200
	SCT-76, SCT-80, SCT-94, SCT-108, SCT-120	PMG-200	(2)PMG-200
	U-31-A, U-31-AC	PMG-100	PMG-200
	U-31-A2	PMG-200	(2)PMG-200
	SC-2-3-4, SC-5-2-3-4	PMG-200	---
	SC20-2	---	PMG-100
	SC-2-8, SC-2-9, SC-1-2-8, SC-5-6-8, SC-6-8, SC-6-9, SC-1-6-8, SC-5-6-9, SC-5-2-9, SC-1-6-9, SC-5-2-8	PMG-100	PMG-200

* Hobart Model AM-12 with serial no. 12-067-357 or below and model AM-12C with serial no. 12-067-537 or below require slightly larger booster than listed. Or C Models with serial no. 85-1041605 or greater use Opti-RinSe.

Shaded area indicates older models prior to Opti-RinSe.

† Powermite installations above 2,000 ft. (610 m) will reduce the above capacities and may require change of pressure and/or orifices in certain models at time of install to meet IAS safety compliance. These modifications are the responsibility of the installer. Consult “Installation and Operating Manual” for sizing adjustments and orifice changes.

This selector chart is based on 40°F (22°C) and 70°F (39°C) temperature rises, 20 psi flow pressure, and minimum rinse cycle timer setting in NSF listing.

All booster heaters are rated at 100% of the capacity of the dishwashers as recommended by the National Sanitation Foundation. Where make-up water for wash tank is provided from final rinse supply, chart recommendations are based upon this additional demand (not over 2 GPM) as required by NSF.

All sizings shown are that of the dishwasher manufacturers. Hatco Corporation is not responsible for incorrect sizing applications.

GENERAL

Code Requirements

Installation must be in accordance with local codes, or in the absence of local codes, with the latest edition of the National Fuel Gas Code, ANSI Z223.1, the National Electrical Code, ANSI/NFPA 70. Canadian installations should conform with CSA-B149.1, Natural Gas and Propane Installation Code, and CSA-C22.1 Electrical Code, and/or local installation codes. *{Les installations canadiennes doivent se conformer aux CODES D'INSTALLATION CSA-B149.1, Natural Gas and Propane Installation Code, et CSA-C22.1 Electrical Code, et/ou aux codes locaux d'installation.}*

NOTE: In the Commonwealth of Massachusetts, Hatco Booster Heaters shall be installed by a licensed plumber and gasfitter.

NOTE: The Commonwealth of Massachusetts requires that if a water treatment system is installed in line with the Hatco Booster Heaters, a water backflow protector shall also be installed.

NOTE: If a check valve or water backflow protector is installed and cannot be removed install a back pressure relief valve, Hatco part number 03.02.039.00, set at 125 psi (862 kPa) on the incoming line between the pressure reducing valve and the inlet to the booster heater. Discharge must be to open site drain.

For the most effective operation, install the Hatco Gas Booster Heater as close as possible to the dishwashing machine.

NOTE: Employ external recirculation if distance between booster and dishwasher exceeds the National Sanitation Foundation specifications of five (5) feet (1.5 m).

⚠ CAUTION

Unit is not weatherproof. For safe and proper operation the unit must be located indoors where the ambient air temperature is constant and is a minimum of 70°F (21°C).

⚠ WARNING

To assure proper operation and avoid a possible unsafe condition, the booster heater must be installed in a horizontal position with the base parallel to the floor and the inlet connection at the lowest point.

The Booster Heater must not be installed directly on carpeting, but on top of a metal, wood (or equivalent) panel extending beyond the full width and depth of the booster heater by at least 3" (76 mm) in any direction or, if the heater is installed in an alcove, the entire floor must be covered by the panel. The panel must be strong enough to carry the weight of the heater when full of water.

Adequate front clearance is required to allow for accessibility to the control compartment.

The booster heater should be located in an area where leakage of the tank or connections will not result in damage to the area adjacent to the heater or to lower floors of the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the booster heater. The pan must not restrict combustion air flow.

INSTALLATION

Combustion/Ventilation Air

The booster heater must be located in an area which allows for an adequate supply of air for proper combustion and ventilation in accordance with Section 5.3 and 7.2.2 of the National Fuel Gas Code NFPA54/ANSI Z223.1 or applicable provisions of the local building codes. Only a single booster appliance may be installed in this manner. **Installations under the jurisdiction of Canadian CSA-B149.1, Natural Gas and Propane Installation Code, require a gas interlock tied into the ventilation hood system.** ***{Les installations sous la juridiction des CODES D'INSTALLATION canadiens CSA-B149.1, Natural Gas and Propane Installation code, nécessitent un verrouillage réciproque de gaz raccordé au système de capot de ventilation.}***

⚠ WARNING/CAUTION

The flow of air to the heater for combustion and ventilation must not be obstructed. Air vents on the bottom and side of the unit should never be blocked. All panels should be in place during normal operation for optimal performance and safety.

⚠ WARNING/CAUTION

This unit is designed to vent to the outside or into an open Equipment Hood, and is intended for commercial food service water heating only. IT IS NOT FOR RESIDENTIAL USE. See *VENT* section of this manual.

⚠ WARNING/CAUTION

Flue gases exit top side or back of this unit and must not be obstructed, specified clearances must be maintained for safe operation. See *VENT* section for vent piping alternatives.

Minimum Clearance Requirements: *{Exigences quant au dégagement minimum:}*

Floor *{Sol}*	Top *{Dessus}*	Left Side *{Côté gauche}*	Right Side *{Côté droit}*	Front *{Devant}*	Back *{Derrière}*
6"* (152 mm)	1" (25 mm)	2" (51 mm)	2" (51 mm)	20" (508 mm)	2" (51 mm)†

* Includes legs supplied with booster heater *{Comrend pieds fournis avec appareil de chauffage auxiliare}.*
† Minimum clearance of 8" (203 mm) from the side of the appliance where the vent is installed.

High Altitude Installation and Operation

Atmospheric conditions at elevations above 2000 ft. (610 m) have an effect on the performance of most gas fired products. For this reason, historical models for altitude de-rating were developed for gas appliances with atmospheric burners. The National Fuel Gas Code, ANSI Z223.1 is an accepted model which requires a de-rating of 4% per 1000 ft. (305 m) elevation when no testing to the contrary exists for that product. This could require modifying the equipment and adjusting settings in the field to achieve de-rating. Testing has shown this to be a very conservative approach.

Manufacturers discourage unnecessary field adjustments in order to maintain a level of performance and quality designed into the product. For these and other reasons, testing was underwritten through CSA International to verify an improved satisfactory performance with little or no modification to effect input rate or control. The following text and charts are a result of this testing and should be used during application sizing and installation.

- The **PMG-100** can operate at better levels than ANSI Z223.1 without manifold pressure setting adjustments or orifice changes up to the 8500 ft. (2593 m) elevation for *both natural gas and liquid propane gas units.* Above this level only a slight decrease in manifold pressure may be needed to meet the approved BTU rate. This is shown in the Altitude Summary chart. Also, note that GPH capacity will be reduced and a guideline is given as to the percent of sea level capacity expected.

For Canadian installations between 2000-4500 feet (610-1370 m) de-rate unit by 10% to 94,500 BTU.

{Pour les installations au Canada entre 610 et 1370 m (2000 et 4500 pi) reclassifier l'appareil de 10% à 94 500 BTU.}

- **PMG-200** will require orifice changes at levels shown in the Altitude Summary chart. This follows the 4% de-rating scheme outlined in ANSI Z223.1 for *both natural gas and liquid propane gas.* Also note that the GPH capacity will be reduced and a guideline is given as to the percent of sea level capacity expected.

For Canadian installations between 2000-4500 feet (610-1370 m) de-rate unit by 10% to 175,500 BTU.

{Pour les installations au Canada entre 610 et 1370 m (2000 et 4500 pi) reclassifier l'appareil de 10% à 175 500 BTU}

Orifice Kits for altitude installations may be ordered through Hatco Customer Service. Please call for orifice sizing information.

Altitude Summary Publication Data for PMG Boosters

NATURAL GAS

Altitude: *Ft. Above Sea Level (Meters)*	**0-2000 (0-610)**	**2001-3000 (610-915)**	**3001-4000 (915-1220)**	**4001-5000 (1220-1525)**	**5001-6000 (1525-1830)**	**6001-7000 (1830-2135)**	**7001-8000 (2135-2440)**	**8001-8500 (2440-2593)**	**8501-9500 (2593-2898)**	**9501-10500 (2898-3203)**
PMG-100 Approved Input Rate*	105000	103363	101726	100089	98452	96815	95178	94360	90585	86811
Suggested Orifice Size†	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS	#**34**DMS
GPH Capacity De-Rate•	1	0.98	0.97	0.95	0.94	0.92	0.91	0.90	0.86	0.83
PMG-200 Approved Input Rate*	195000	171600	163800	156000	148200	140400	132600	128700	123552	118404
Suggested Orifice Size†	#**35**DMS	#**36**DMS	#**36**DMS	#**37**DMS	#**37**DMS	#**38**DMS	#**39**DMS	#**40**DMS	#**41**DMS	#**42**DMS
GPH Capacity De-rate•	1	0.88	0.84	0.80	0.76	0.72	0.68	0.66	0.63	0.61

LIQUID PROPANE GAS

Altitude: *Ft. Above Sea Level (Meters)*	**0-2000 (0-610)**	**2001-3000 (610-915)**	**3001-4000 (915-1220)**	**4001-5000 (1220-1525)**	**5001-6000 (1525-1830)**	**6001-7000 (1830-2135)**	**7001-8000 (2135-2440)**	**8001-8500 (2440-2593)**	**8501-9500 (2593-2898)**	**9501-10500 (2898-3203)**
PMG-100 *LPG* Approved Input Rate*	105000	102937	100874	98810	96747	94684	92621	91589	87925	84262
Suggested Orifice Size†	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS	#**50**DMS
GPH Capacity De-Rate•	1	0.98	0.96	0.94	0.92	0.90	0.88	0.87	0.84	0.80
PMG-200 *LPG* Approved Input Rate*	195000	171600	163800	156000	148200	140400	132600	128700	123552	118404
Suggested Orifice Size†	#**50**DMS	#**51**DMS	#**51**DMS	#**51**DMS	#**51**DMS	#**52**DMS	#**52**DMS	#**52**DMS	#**53**DMS	#**53**DMS
GPH Capacity De-rate•	1	0.88	0.84	0.80	0.76	0.72	0.68	0.66	0.63	0.61

Notes:

* This is the maximum allowable BTU rate certified by CSA. These are to be verified by the qualified gas installer on site. *Check Heat Value with local Gas Utility*

† The first orifice size is the factory built unit.
The next sizes are shown at the altitudes where a change is required to allow pressure adjustments to the approved input rates.

• This is a de-rate multiplier to use when sizing a gas booster for a given application.
Take this value and multiply it by the GPH found on the Hatco sizing chart to ensure it will provide the capacity you need.
You can also use this value by dividing it into your capacity needs and take the resulting *adjusted GPH* to the sizing chart to select a gas booster.

PLUMBING

Components

SUPPLIED WITH UNIT	OPTIONAL WITH UNIT	SUPPLIED BY INSTALLER
• Temperature/Pressure Relief Valve • Blended Phosphate Water Treatment System • Pressure Reducing Valve • Temperature/Pressure Gauges (2) • Shock Absorber • 3/4" Plug (installed)	• Back Pressure Relief Valve	• 3/4" Gate or Ball Valve • Drain Valve • 3/4" Unions • 3/4" Piping

Pressure And Temperature Relief Valves

For protection against excessive pressures and temperatures in the booster heater, install temperature and pressure protective equipment by local codes. Hatco supplies valves constructed with brass working parts and heat resistant silicone seat discs for all booster heater models.

⚠ WARNING

Valves supplied by Hatco are designed for high temperature commercial operation. Do not substitute Hatco valves with valves designed for domestic water heaters.

Temperature/pressure protective equipment should not be less than a combination temperature/pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of the production of this equipment and meets the requirements for Relief Valves and Automatic Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22*CSA 4.4. The temperature/pressure relief valve must be marked with a minimum set pressure not to exceed the marked maximum working pressure of the booster heater.

⚠ CAUTION

Do not use an anti-siphon or check valve on the incoming water line.

NOTE: If a check valve or water backflow protector is installed and cannot be removed install a back pressure relief valve, Hatco part number 03.02.039.00, set at 125 psi (862 kPa) on the incoming line between the pressure reducing valve and the inlet to the booster heater. Discharge must be to open site drain.

⚠ CAUTION

FOR INSTALLING PRESSURE AND TEMPERATURE RELIEF VALVES IN ACCORDANCE WITH ANSI Z21.22*CSA 4.4. Combination pressure and temperature relief valves with extension thermostats must be installed so that the temperature-sensing element is immersed in the water within the top 6" (152 mm) of the tank. They must be installed either in the hot outlet service line or directly in a tank tapping. Combination pressure and temperature relief valves that do not have extension elements must be mounted directly in a tank tapping located within the top 6" (152 mm) of the tank, and shall be adequately insulated and located so as to assure isolation from flue gas heat or other ambient conditions that are not indicative of stored water temperature. TO AVOID WATER DAMAGE OR SCALDING DUE TO VALVE OPERATION, DRAIN PIPE MUST BE CONNECTED TO VALVE OUTLET AND RUN TO A SAFE PLACE OF DISPOSAL. Drain pipe must be as short as possible and be the same size as the valve discharge connection throughout its entire length. Drain line must pitch downward from the valve and terminate at least 6" (152 mm) above the floor drain where any discharge will be clearly visible. The drain line shall terminate plain, not threaded, with a material serviceable for temperatures up to 250°F (121°C) or greater. Excessive length, over 15' (4.57 m), or use of more than two elbows can cause a restriction and reduce the discharge capacity of the valve. No shut-off valve shall be installed between the relief valve and tank, or in the drain line. Valve lever must be tripped periodically to ensure that waterways are clear. This device is designated for emergency safety relief and shall not be used as an operating control. The valves are set to relieve at 150 pounds pressure or when water temperature reaches 210°F (99°C). Read tag on valve for additional information.

INSTALLATION

Temperature/Pressure Gauges

Hatco requires a temperature/pressure gauge be installed in both the inlet and outlet lines to the booster heater. These gauges provide an instant visual check of the water temperature and pressure entering and leaving the booster heater. The visual check is helpful in eliminating unnecessary service calls.

Install the temperature sensing bulb in the water system. See **Figures 2 and 3** for methods of installation.

Pressure Reducing Valve

Proper operation of most dishwasher rinse nozzles require available water flow pressure at the nozzle to be 20 PSI.

If water pressure available to the booster heater inlet is over 20 PSI, a pressure reducing valve with bypass must be installed in the hot water supply line to the booster heater.

The valve supplied by Hatco has a built-in high pressure bypass which prevents excessive pressure build-up as the booster heats up.

⚠ CAUTION

Pressure regulating valve must have a built-in high pressure bypass.

Blended Phosphate Water Treatment System

Hatco requires that the Blended Phosphate Water Treatment System supplied be installed with unions on the incoming 3/4" water supply line after the pressure reducing valve and before the booster heater.

Cartridges supplied have a usage rating of 100,000 gallons of water. To ensure proper operation the cartridges must be replaced when expired.

NOTE: Product failure caused by liming or sediment buildup is not covered under warranty.

NOTE: The Commonwealth of Massachusetts requires that if a water treatment system is installed in line with the Hatco Booster Heaters, a water backflow protector shall also be installed.

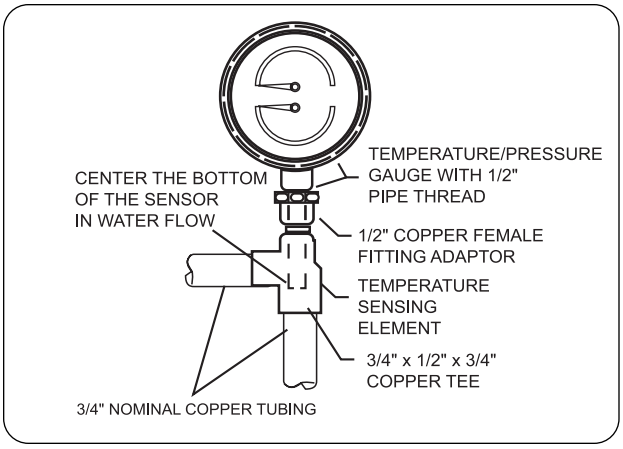


Figure 2. Installation Temperature/Pressure Gauge

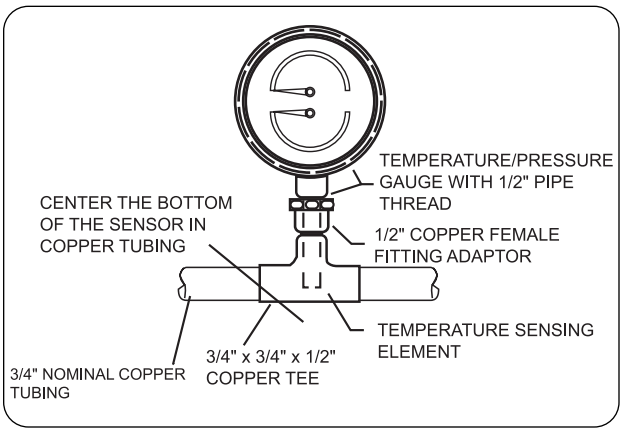


Figure 3. Installation Temperature/Pressure Gauge

NOTE: If a check valve or water backflow protector is installed and cannot be removed install a back pressure relief valve, Hatco part number 03.02.039.00, set at 125 psi (862 kPa) on the incoming line between the pressure reducing valve and the inlet to the booster heater. Discharge must be to open site drain.

PLUMBING CONNECTIONS (See Figure 4)

Inlet

Hatco Booster Heaters are designed to be connected with 3/4" pipe at the inlet pipe from the primary water heater. Water temperature from the primary water heater must be at least 110°F (43°C) and should not exceed 160°F (71°C). Minimum temperature differential between the inlet and outlet temperature must never be less than 20°F (11°C).

NOTE: Refer to BOOSTER HEATER SIZING CHART *for application information.*

Inlet line **must** be installed with a shut-off valve, a full open gate or ball type valve, a 3/4" union, together with the blended phosphate water treatment system, pressure reducing valve set at 20 PSI (1.4 kg/cm^2) flow pressure and a temperature/pressure gauge supplied by Hatco.

NOTE: Do not run a cold ground water line to the Booster Heater.

CAUTION

Incoming water supply in excess of 3 grains of hardness per gallon ([GPG] .75 grains of hardness per liter [GPL]) must be treated/softened before being supplied to booster heater(s). Water that contains over 3 GPG or .75 GPL will decrease efficiency and reduce the operating life of the unit. ***NOTE: Product failure caused by liming or sediment buildup is not covered under warranty.***

CAUTION

Incoming water supply to booster heater must be a minimum of 20 psi, (1.4 kg/cm^2) water pressure less than 20 psi (1.4 kg/cm^2) will decrease the operating life of the recirculating pump and the unit.
NOTE: Product failure caused by incoming water pressure less than 20 psi (1.4 kg/cm^2) is not covered under warranty.

⚠ CAUTION

To avoid development of a leak, do not back up or loosen any water pipe fittings.

⚠ WARNING

Do not connect the heater directly to a boiler or furnace coil or any other uncontrolled temperature source. Such hook-up could cause the thermostat to lose control and the unit could overheat.

INSTALLATION

NOTE: Be sure water flows through the pressure reducing valve in the proper direction. Check the directional arrow. Valve will reduce pressure only during flow conditions.

A 3/4" union fitting and a drain valve must also be installed to allow for easy servicing.

The temperature/pressure relief valve must be installed into one of two locations on the heater: either the right side or the back of the unit. See Figure 4 for exact locations.

To prevent water leakage and damage to the unit, the location for the temperature/pressure relief valve that is **not used** must be plugged. (One plug is supplied by Hatco with the heater.) Both temperature/pressure fittings MUST NOT be plugged.

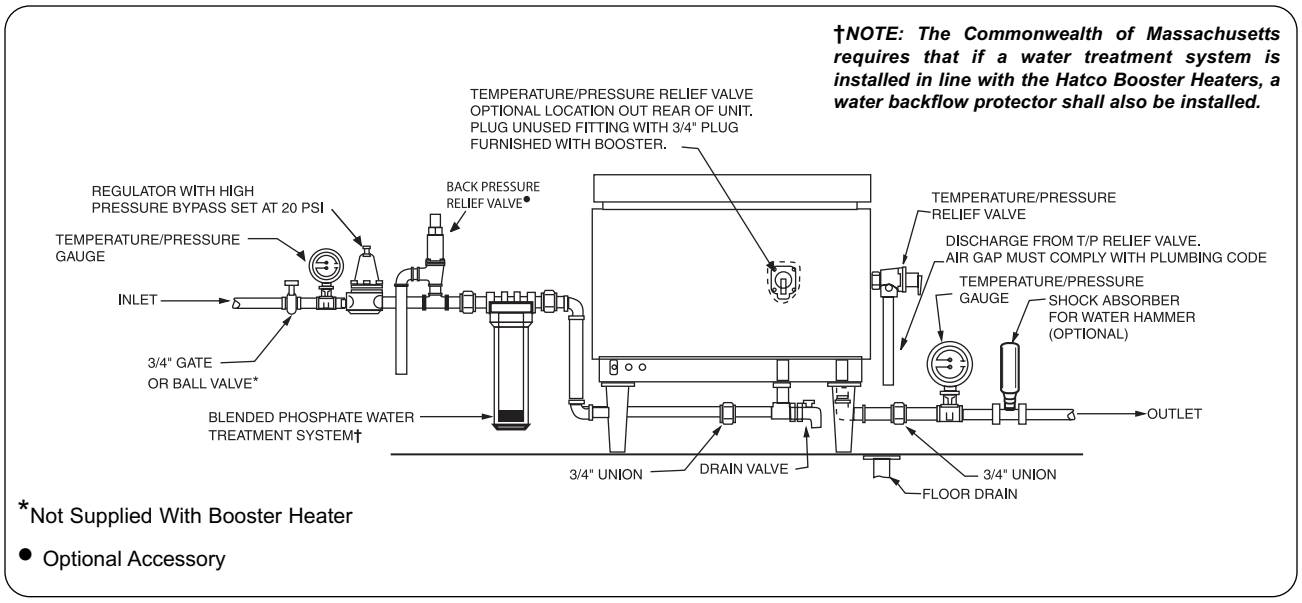


Figure 4. Plumbing Connections – PMG-100/200 Gas Booster Heaters

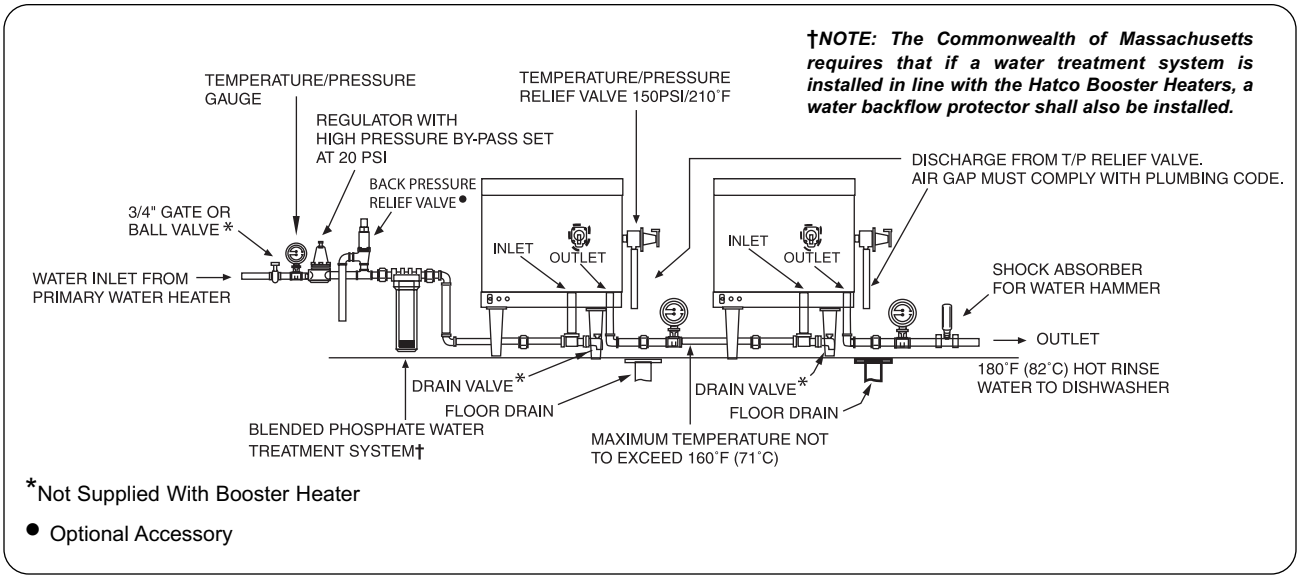


Figure 5. PMG-100/200 Gas Booster Heaters Connected in Series

Outlet

Using a 3/4" union and piping, connect the booster heater water outlet to the dishwasher sanitizing rinse pipe connection.

NOTE: Be certain the connection is made to the final rinse and not to the wash tank.

Install a temperature/pressure gauge in outlet line. Water temperature at outlet should be 180°F (82°C).

NOTE: The temperature sensing element must be in water stream. (See Figures 2 and 3.)

Shock Absorber

In areas of high water pressure, Hatco recommends a shock absorber be installed in the outlet line as close as possible to the dishwasher. The shock absorber softens the water hammer caused by automatic dishwasher valves. (See Figure 4.)

NOTE: Fill booster heater with water to test for installation leaks. Leave the water in booster to prevent pump damage in the event the electrician should apply power.

GAS

Components

SUPPLIED WITH UNIT	OPTIONAL WITH UNIT	SUPPLIED BY INSTALLER
• Internal Gas Valve (installed) • External Gas Shutoff Valve (loose)	None	• Gas Supply Line • Sediment Trap • Union • Vent System

INSTALLATION

Gas Piping

The gas inlet pipe size is 3/4" NPT pipe thread fitting to the gas valve. Provide an adequate size gas supply line. The line should never be smaller than 3/4" NPT and should follow according to the gas piping diagram below. The fitting is accessed through the bottom of the case. (See Figure 6.)

NOTE: Gas line should be of the approved type for use with natural gas or propane.

⚠ CAUTION

Do not use Teflon tape on gas line pipe threads. A flexible sealant suitable for use with applied gas is recommended.

Gas line should be kept as short as possible, sized to furnish the rated BTU, and installed in a way to protect it from damage. Gas piping must be installed in accordance with local plumbing codes including a sediment trap, ahead of the heater gas controls and a manual shut-off valve located outside the jacket.

NOTE: The internal gas valve is supplied with the heater, the external manual gas valve supplied with unit must be plumbed in by the installer. See Figure 6 for gas piping diagram.

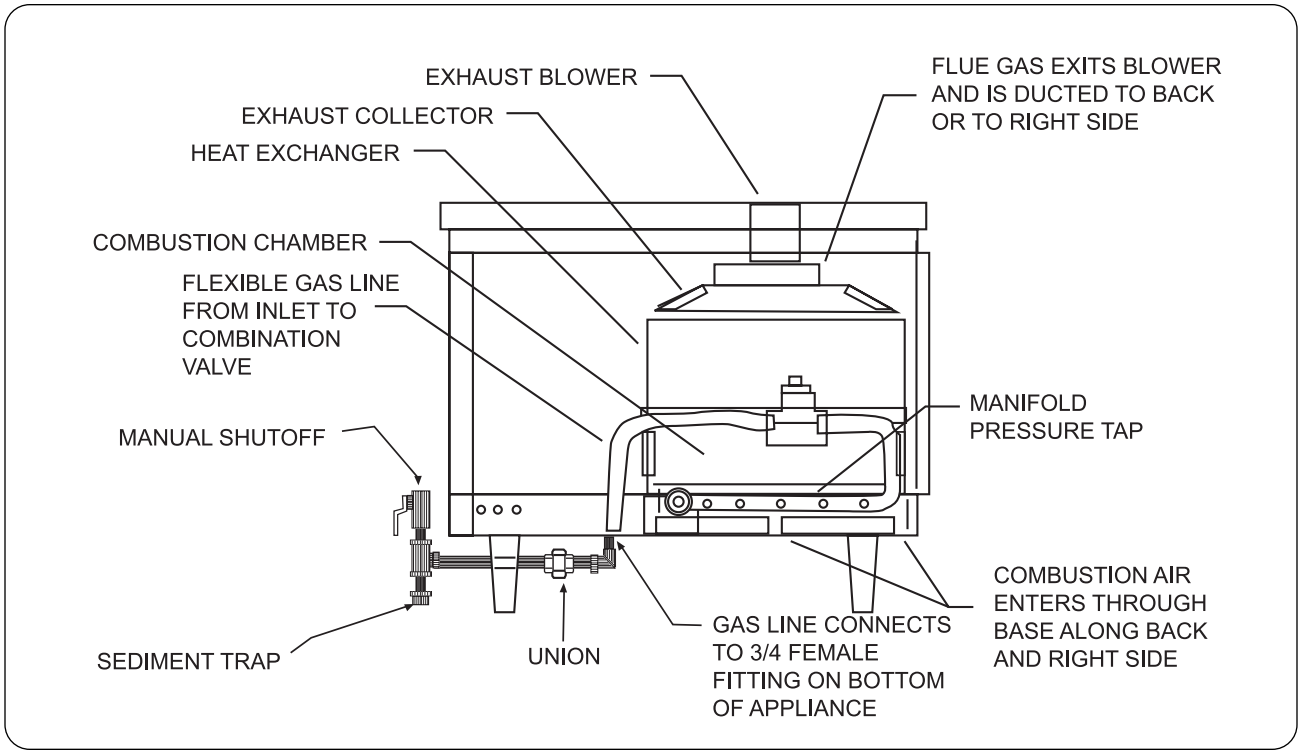


Figure 6. Gas Hook-up and Pressure Tap Location and Piping Diagram.

⚠ WARNING/CAUTION

The gas used with this unit must be the type specified on the spec plate on this unit. To avoid personal injury or damage to the unit, never use any other than the specified gas.

The heater and its gas connection must be leak tested before placing the booster heater in operation.

The booster heater and its individual shut-off valve must be disconnected and isolated from the gas supply piping system during any pressure testing of the system at test pressures in excess of 1/2 PSI (3.5 kPa.).

This appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

Dissipate test pressure from the gas supply line before re-connecting the heater and its manual shut-off cock to the gas supply line. FAILURE TO FOLLOW THIS PROCEDURE MAY DAMAGE THE GAS VALVE. OVER PRESSURED GAS VALVES ARE NOT COVERED BY THE WARRANTY.

The heater and its gas connections shall be leak tested before placing the appliance in operation. Use soapy water or commercially available fluid for leak test. DO NOT use open flame to test for leaks.

Incoming Gas Pressure Specifications

	Inches Water Column	
Gas Type	Minimum	Maximum
Natural	5.0	10.5
Propane/LP	11.0	13.0

The maximum inlet gas pressure must not exceed the values shown above. The minimum gas pressure listed is for the purposes of input adjustment.

The manifold inside the heater is provided with a pressure tap to measure the gas pressure. The chart below lists the proper pressure amounts at the manifold pressure tap when testing.

Operating Pressure Specifications at Manifold

	Inches Water Column At Pressure Tap
Gas Type	High Burn
Natural	3.5
Propane/LP	10.0

See Figure 6 for hook-up location and pressure tap location.

INSTALLATION

ELECTRICAL

Components

SUPPLIED WITH UNIT	OPTIONAL WITH UNIT	SUPPLIED BY INSTALLER
• 7/8" Hole Plugs	None	• 120 VAC, 60 Hz, 15 Amp Single Phase Service • Electrical Ground

The Hatco Gas Booster Heater operates on 120 VAC, 60 Hz, 15 amp, single phase service. All internal electrical connections have been made at the factory.

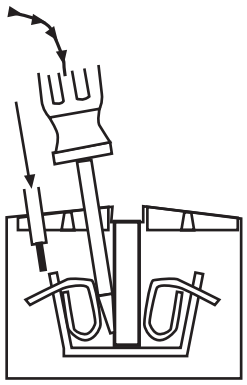
⚠ WARNING

If an external electrical source is utilized, the appliance, when installed, must be electrically grounded in accordance with local codes, or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, and CSA C22.1, Electrical Code.

Electrical Connections

To connect the field wiring to the booster heater:

1. Remove the front access panel from the unit by lifting up on the front panel and pulling upper edge away from unit until it clears the lower edge.
2. Open electrical enclosure at the lower left corner of the base by removing two screws.
3. Bring power leads from a properly sized fused disconnect switch or circuit breaker through 7/8" hole provided on lower left hand side or bottom of base. Connect supply lines to terminal block provided. (See Figure 7.) **Use copper wire only.**
4. A green grounding terminal is provided internally. An equipment grounding conductor must be properly connected to the green terminal block. (See Figure 7.)



1. Rotate Screwdriver into top opening.
2. Insert 3/8" Stripped Wire Lead.
3. Remove Screwdriver.

Figure 7. Terminal Block Wiring Instructions.

CAUTION

To avoid damage to both the pump and heater assembly, do not turn on the power switch to the heater until the installation is complete and the booster water tank is filled with water and all air in the system has been vented through the dishwasher rinse nozzles.

VENTING

The PMG-100 and PMG-200 may be vented by two methods, both of which have been tested for compliance with national safety standards for gas water heaters. Whichever method is used must comply with local codes. The installation of the venting system must comply with local codes and in the absence of local codes, in accordance with the National Fuel Gas Code and the guidelines in this manual. ***Before installing any method of venting you should contact the local code authority of your gas supplier to make sure that the final installation will be acceptable to the authorities having jurisdiction.***

The proper method of venting a power vented gas appliance is too complicated to cover in this manual and is explained in detail in the National Fuel Gas Code. Before installing the venting system the person or agency making the installation must be familiar and experienced with the guidelines of the National Fuel Gas Code.

The temperature of the flue gases from this booster water heater operates at approximately 225°F to 275°F (107°C to 135°C).

The two methods that have been tested for compliance with the national safety standards are:

1. The first method of venting permits the connection of 4" (102 mm) diameter, AL 29-4C[1] stainless steel vent pipe. Use only the specific types of materials currently listed by a nationally recognized testing agency for category III venting. **The maximum combined horizontal vent length must not exceed a length of 40 feet (12 m) [each sweep elbow is the equivalent of 5' (1.5 m) of straight pipe and a standard right elbow is the equivalent of 10 feet (3 m)].** The venting may be done in such a way that the exhaust products are:

   a. Conveyed to another area in the kitchen such as under a ventilator or near an exhaust fan (both of which exhaust outdoors). (See Figure 8.)

      When using this method the booster water heater must be electrically interlocked with the vent hood to prevent operation if the vent hood is not operating.

      The termination end must be placed so that it vents above the bottom of the hood skirt. Do not penetrate the filter with the vent.

   b. Horizontally vented through an outside wall directly to the outdoors. See additional instructions below. (See Figure 9.)

   c. Exhausted into a vertical masonry chimney that has a listed steel liner installed in the chimney. Locate appliance as close as practicable to a chimney or gas vent. Because of the low flue gas temperature, do not vent into an unlined or masonry lined chimney. Note that all venting into a vertical chimney of any type must comply with the horizontal and vertical ratios and sizing requirements that are detailed in the National Fuel Gas Code.

   d. Vented vertically using type B vent pipe that is 5" (127 mm) in diameter provided the termination above the roof uses a listed wind cap.

[1]AL 29-4C is a Registered Trademark of Allegheny Ludlum Corp.

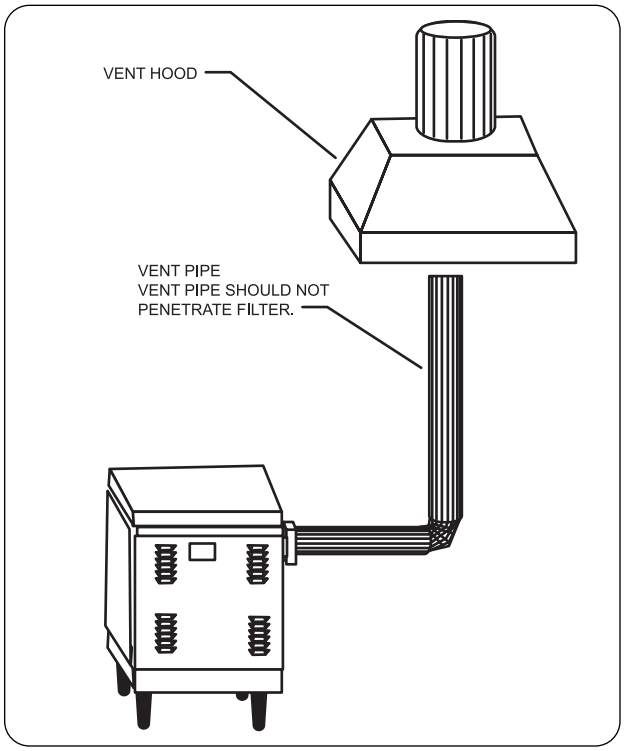


Figure 8. Venting Through Typical Exhaust System.

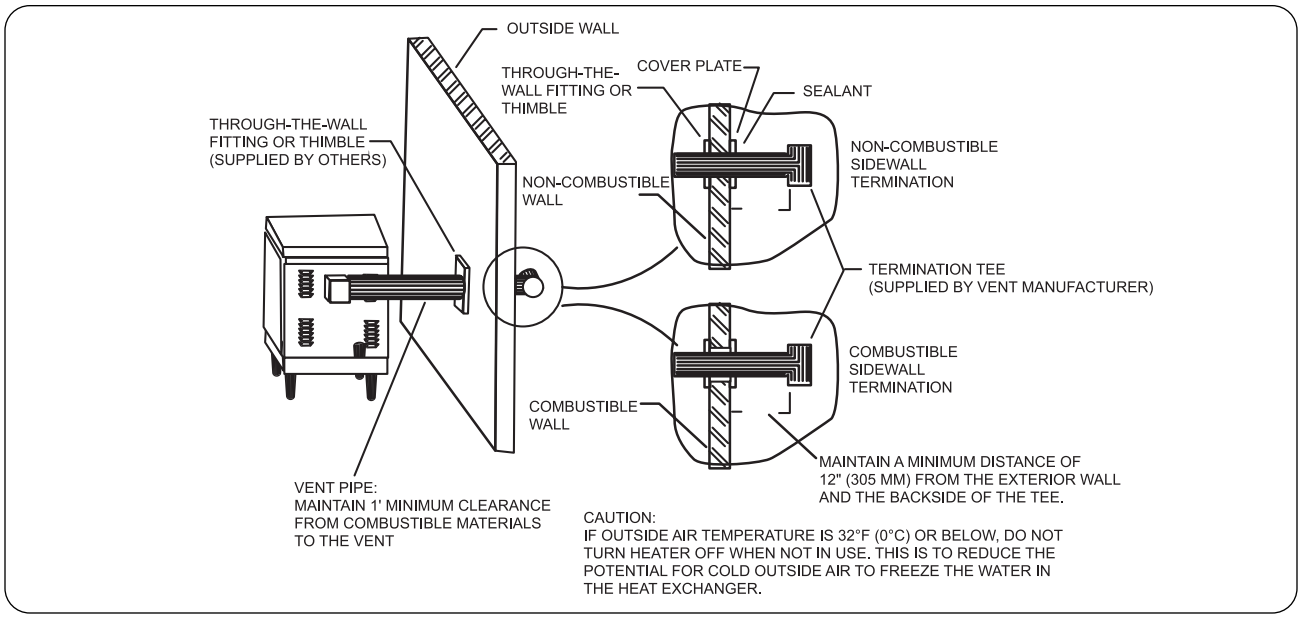


Figure 9. Typical Through-the-Wall Venting

2. The second method of venting is to directly exhaust the flue products into the kitchen work area provided the size and installation of the open room meet the requirements of the National Fuel Gas Code [ANSI Z223.1 or NFPA bulletin #54]. A portion of the 1996 code is as follows.

EXCERPT FROM ANSIZ223.1/NFPA #54

7.2.1 Connection To Venting Systems. Excerpt as permitted in 7.2.2 through 7.2.6, all gas utilization equipment shall be connected to venting systems.

7.2.2 Equipment Not Required To Be Vented. A single booster-type [automatic instantaneous] water heater, when designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the equipment is installed, with the draft hood in place and unaltered, if a draft hood is required in a commercial kitchen having a mechanical exhaust system. Where installed in this manner, the draft hood shall not be less than 36 inches (91 cm) vertically and 6 inches (15 cm) horizontally from any surface other than the equipment.

Where any or all of this equipment is installed so the aggregate input rating exceeds 20 Btu per hr per cu ft (207 watts per m^3) of room space in which it is installed, one or more shall be provided with venting systems or other approved means for removing the vent gases to the outside atmosphere so the aggregate input rating of the remaining unvented equipment does not exceed the 20 Btu per hr per cu ft (207 watts per m^3) figure. Where the room or space in which the equipment is installed is directly connected to another room or space by a doorway, archway, or other opening of comparable size that cannot be closed, the volume of adjacent room or space shall be permitted to be included in the calculation.

General Notes On Venting:

- Whenever a vent pipe goes through a combustible wall, the clearance between the vent material and the combustible material must be in accordance with the listing requirements of the vent system chosen. See the vent manufacturer's instructions.
- All horizontal runs of vent pipe must be supported at every elbow and every 3 feet (1 m).
- All horizontals must have an upward pitch of at least 1/4" per foot.
- When venting through a side wall to the outdoors the following must be observed:
- A vent termination [Tee Fitting] must be used that is positioned with the backside of the TEE at least 12" (305 mm) from the exterior wall.
- The vent termination must be away from areas where the general public will walk or vehicle may damage the vent cap.
- The cap must be at least 3 feet (1 m) above any forced inlet openings [into the building] that are within 10 feet (3 m) of the cap.
- The cap must be one foot above any windows, doors or other openings into the building.

- The cap must be 4 feet (1.2 m) horizontally from any doors, windows, etc.
- The cap must be at least 7 feet (2 m) above any public walkway.
- The bottom of the cap must be at least 1 foot (.3 m) above ground and possibly higher if the snow accumulation normally exceeds 1 foot (.3 m).
- The cap should be positioned such that any condensate that drips from the cap will not damage plants, shrubs or onto other equipment located on the outside of the restaurant.
- The cap should be positioned so that condensate that drips from the cap will not allow the water to accumulate on walkways or other areas, which may freeze and cause an accident.
- Right angle adapter is provided to minimize radius of initial bend toward flue piping required for tight quarters. See Figure 10 for direction options.

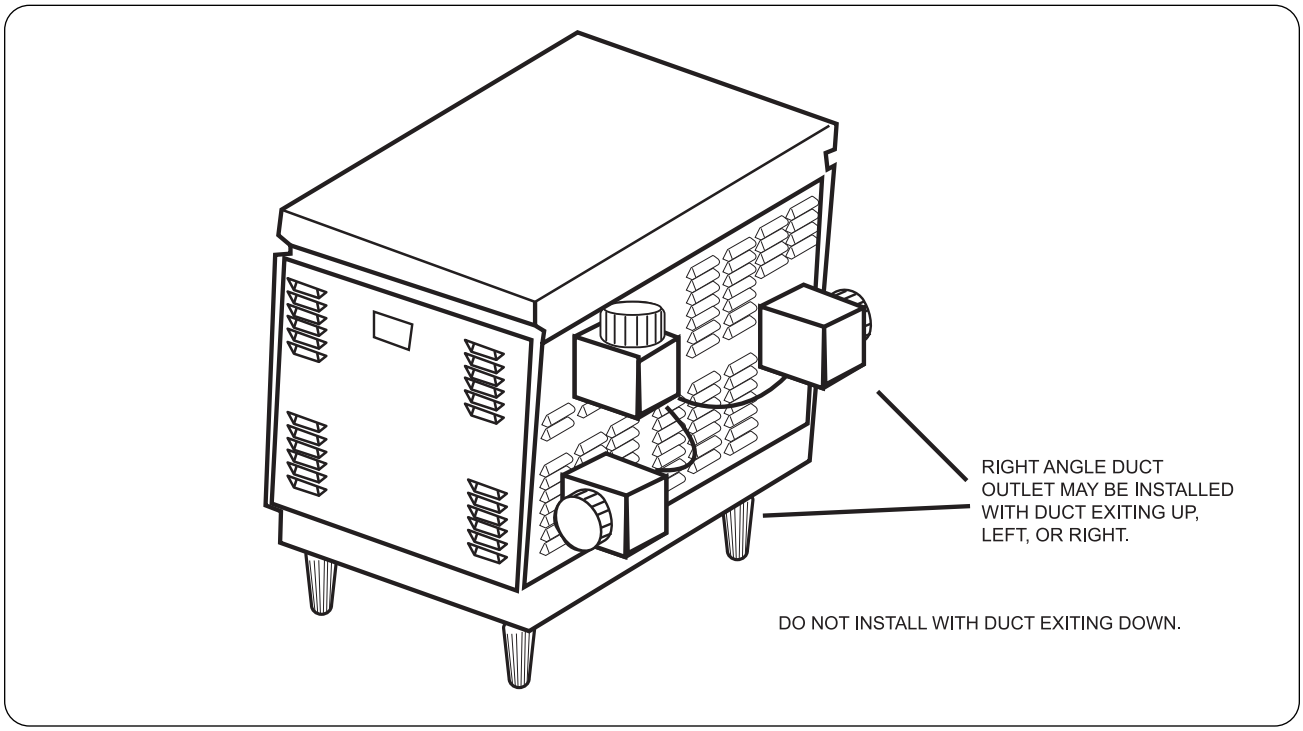


Figure 10. Right Angle Adapter Mounting Options.

NOTE: The standard Vent Outlet is shown in Figure 10 exiting from the rear. To adjust the outlet exit to the right side see the COMPONENT-ADJUSTMENT/REPLACEMENT *section of this manual.*

CAUTION

To avoid FREEZING WATER DAMAGE to the booster heater when the outside temperature is below 32°F (0°C) the unit must be left ON and the venting must be protected from migrating cold air.

OPERATION

START UP PROCEDURES

NOTE: Remove the front access panel during start up.

Filling The System With Water

1. **With the external gas supply and electric supply turned off,** close the drain pipe valve.

NOTE: Water temperature at the inlet should be between 110°F (43°C) and 150°F (66°C) and should never exceed 160°F (71°C) for the unit to operate properly and meet the demands of the dishwashing machine. Minimum temperature differential between inlet and outlet temperatures should never be less than 20°F (11°C).

NOTE: Do not run a cold ground water line to the Booster Heater(s).

CAUTION

Incoming water supply in excess of 3 grains of hardness per gallon ([GPG] .75 grains of hardness per liter [GPL]) must be treated/softened before being supplied to booster heater(s). Water that contains over 3 GPG or .75 GPL will decrease efficiency and reduce the operating life of the unit. *NOTE: Product failure caused by liming or sediment buildup is not covered under warranty.*

2. When the water tank is full, turn on the electric supply and the power switch to allow the circulator pump to purge air from it. The circulator pump should start immediately. Additional air in the tank can be vented through the dishwasher rinse nozzle.

NOTE: Dishwasher should be cycled a minimum of three times before the gas supply to the booster is turned on.

3. **After all the air has been vented out of the system, turn off the power to the booster heater.**

CAUTION

Product failure caused by dry firing is not covered under warranty.

Lighting The Heater

FOR YOUR SAFETY, READ BEFORE OPERATING:

⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result, causing property damage, personal injury or loss of life.

AVERTISSEMENT: Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort.

1. This appliance is equipped with an ignition device which automatically lights the pilot. **DO NOT** TRY TO LIGHT THE PILOT BY HAND.

2. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

   What To Do If You Smell Gas:

   - Do not try to light any appliance.
   - Do not touch any electric switch; do not use any phone in your building.
   - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
   - If you cannot reach your gas supplier, call the fire department.

3. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it - call a qualified service technician. Force or attempted repair may result in a fire or explosion.

4. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

Operating Instructions:

Les Instructions quant a la nise en service de ce chauffe-eau se trouvent sur la surface interieure du ponneau avant. Pour retirer le panneau, saisar les cotes avont interieurs du panneau avant et soulever vers le haut, tirer le bord inferieur vers l'exterieur et laisser le bord superieur tomber.

⚠ WARNING/CAUTION

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance.

En cas de surchauffe ou si l'alimentation en gaz ne s'arrête pas, fermez manuellement le robinet d'arrêt de l'admission de gaz.

1. **STOP!** Read the safety information on the appliance label or in this manual.
2. Turn off all electric power to the appliance.
3. This booster heater is equipped with an ignition device which automatically lights the pilot. **DO NOT** try to light the pilot by hand.
4. To gain access to controls remove front panel by sliding it up and pulling lower edge out and down away from the appliance.
5. Turn gas control knob clockwise to OFF. (See Figure 11.)
6. Wait five (5) minutes to clear out any gas. If you smell gas STOP! Follow “B” in the safety information under Start Up Procedures. If you do not smell gas, continue to the next step.
7. Turn gas control knob counterclockwise to ON.
8. Replace front access panel.
9. Turn on all electric power to the appliance.
10. Turn on power switch and:
    a. After approximately 20 seconds the ignition sequence should begin and light the pilot. If the water temperature is below the setpoint the heating process will start.
    b. Allow the booster heater to run until the burner shuts down. The booster heater is now at its setpoint, stabilized working temperature.
    c. Run the dishwashing machine through at least two rinse cycles. After the first rinse cycles. After the first rinse cycle the burner should re-light and remain lit until the water maintains 180°-185°F (82°-85°C) output @ 20 psi through the second cycle.

    NOTE: If this test does not proceed as described, contact the Hatco Corporation or your authorized service agent for technical assistance.
11. If the appliance will not operate, follow the instructions “To Turn Off Gas To Appliance” and call your service technician or gas supplier.

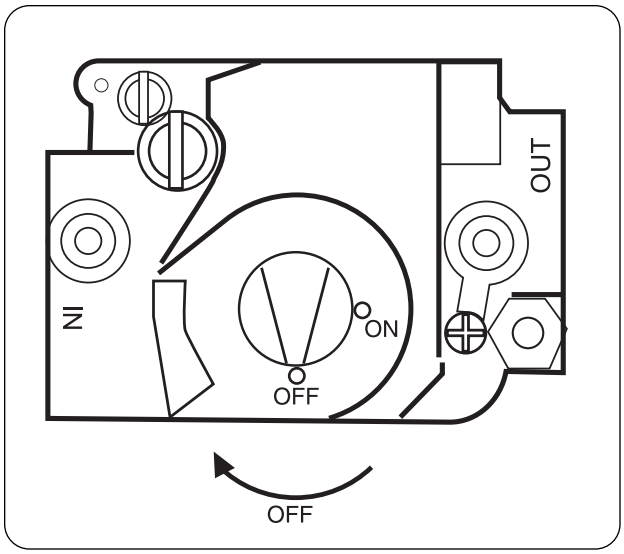


Figure 11. Gas Valve - Top View

To Turn Off Gas To Appliance:

1. Turn off power switch on heater.
2. Turn off all electric power to the appliance if service is to be performed.
3. Shut off external manual gas valve.
4. Remove front cover of heater for access to the control compartment.
5. Turn gas control knob clockwise to OFF. Do not force.
6. Replace front access panel.

CAUTION

To avoid FREEZING WATER DAMAGE to the booster heater when the outside temperature is below 32°F (0°C) the unit must be left ON and the venting must be protected from migrating cold air.

MAINTENANCE

CAUTION
Using or storing chlorine based products on or near the booster heater may shorten the life of the unit and void the product warranty.

NOTE: Refer to the REPLACEMENT PARTS LIST *for exploded views, part identification and location.*

NOTE: Refer to the WIRING DIAGRAM *for specific electrical information.*

GENERAL

1. Keep the area around the heater free and clear of debris and flammable materials. Do not block air intakes or vents.

2. The recirculating water pump motor is permanently lubricated and requires no other maintenance.

3. Visually observe and inspect the burner and pilot flame every six months. When the burner is operating properly a clean blue flame will be visible. (See Figures 12 and 13.) Depending on the condition of the kitchen environment, the burner may need to be cleaned of lint or grease-laden dust. If any problems are apparent, discontinue use of the heater and contact the Hatco Corporation or your authorized service agent.

4. Visually observe and inspect the heat exchanger and exhaust blower fan. Depending on the condition of the kitchen environment, the heat exchanger and fan may need to be cleaned of lint or grease laden dust. If any problems are apparent, discontinue use of the heater and contact the Hatco Corporation or your authorized service agent.

5. Once a month check and clean (if necessary) all air inlet holes on the side or back of the unit.



- The flame during full burn is a broad blue color. An inner cone slightly lighter in color will also be visible.
- The flame should not be rising off of the face of the burner element.
- Yellow tipped flames suggest a need for adjustment or cleaning of the burner assembly.

Figure 12. Gas Flame.

6. The front access panel should be removed and all components visually inspected at least twice a year. Check for evidence of chafing or heat damage to any wiring or components. Check also for any signs of water leakage at any of the plumbing connections. If there are signs of any damage or leakage contact the Hatco Corporation or your authorized service agent.

7. The relief valve should be manually operated at least once a year to ensure proper operation.

⚠ WARNING
Before performing this operation, care should be taken that any of the discharged water does not come into contact with the operator or surrounding surfaces. The water can be extremely hot and can cause severe scalding and damage to the property.

If the relief valve discharges periodically, do <u>not</u> plug it. If replacing the valve does not stop the discharge, contact your local authorized service agent or the Hatco Corporation.

8. Visually observe and inspect the Blended Phosphate Water Treatment System <u>weekly</u>: To ensure proper operation replace depleted cartridges <u>immediately.</u>

<u>BURNER REMOVAL/INSPECTION</u>
(TO BE PERFORMED BY YOUR AUTHORIZED SERVICE AGENCY)

1. Shut-off the electrical power and gas supply to the heater.

2. Disconnect the internal flexible gas supply line connector at the gas regulator valve.

3. Disconnect the ignition module spark cable.

4. Remove two nuts holding the burner tray to the base.

5. Remove four screws from the front cover of the combustion chamber and remove the cover.

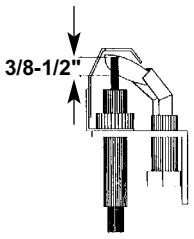


Figure 13. Pilot Flame.

6. Lift and slide burner assembly out.
7. Disconnect spark electrode wire from pilot igniter.
8. Perform intended service.
9. Reverse above procedure to re-install, checking burner assembly and seal to prevent gas leakage.

DRAINING THE HEAT EXCHANGER

1. Shut-off the electrical power, gas and water supply to the heater.
2. Allow unit to cool down to room temperature.
3. Open the drain valve under the booster heater to remove water from the tank and pump assembly.
4. Remove the drain plug located on the front of the heat exchanger and allow the water to drain from the heat exchanger into a pan or pail. Approximately 16 oz. (498 g) of water will drain from the unit.
5. Reverse above procedure using a food grade thread sealant to seal the plug threads and prevent leakage.

CAUTION

Failure to drain the heat exchanger prior to exposing it to freezing conditions will damage the heat exchanger and void the warranty.

NOTE: Freeze damage to the heat exchanger and unit can be avoided by doing the following:

- *After draining heat exchanger, blow 30 psi of air into the heat exchanger drain opening which will purge the exchanger of any residual water.*
- *Leaving drain valves open until performing start-up procedures.*
- *Stop migrating cold air from entering the unit from the vent.*

COMPONENT - ADJUSTMENTS/REPLACEMENTS

⚠ **WARNING/CAUTION**

Always disconnect the power and shut off gas supply prior to performing any maintenance on the booster heater to avoid possible personal injury or damage to the booster heater.

⚠ **WARNING**

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

ATTENTION

Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entrâiner un fonctionnement inadéquat et dangereux.

S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.

1. Gas Valve Replacement
   a. Shut off electrical power and gas supply to the heater.
   b. Remove front panel.
   c. Remove flexible gas piping to gas valve inlet.
   d. Disconnect wiring connections to gas valve.
   e. Remove burner tray assembly as outlined above.
   f. Remove valve from manifold pipe.
   g. Reverse above procedure to re-install, checking burner and seals to prevent gas leakage.
2. Ignition Module Replacement
   a. Shut off electrical power to the booster.
   b. Disconnect spark plug igniter wire.
   c. Remove mounting screws holding module.
   d. Remove module.
   e. Reverse above procedure to re-install.
3. Transformer Replacement
   a. Shut off electrical power to the heater.
   b. Remove screws from electrical box and lift off.
   c. Disconnect wire leads from transformer at the power supply. (See Figure 9.)
   d. Remove mounting screws that hold transformer in place.
   e. Remove transformer from unit and replace with new one.
   f. Reverse above procedure to re-install.

4. Temperature Control Probe Replacement.
   a. Shut off electrical power to the heater.
   b. Shut off water supply to the heater and open drain valve to remove water below the temperature control probe level.
   c. Remove the front panel cover.
   d. Disconnect temperature control probe wire leads from thermostat body.
   e. Remove temperature control probe from tank.
   f. Reverse above procedure to re-install.
5. Recirculating Pump Replacement
   a. Shut off gas supply.
   b. Shut off electrical supply.
   c. Shut off water supply and allow unit to cool sufficiently.
   d. Open the drain valve under the booster heater to remove water from the tank and pump assembly.
   e. Remove front cover and left side panel for access to pump.
   f. Remove two (2) screws from the electrical box cover and lift off.
   g. Remove pump motor cover and disconnect wiring connections to the pump motor.
   h. Remove bolts and nuts holding pump assembly to flanges (save bolts and nuts).
   i. Install new pump assembly using new O-rings (supplied with pump assembly) starting with lower bolts first (FLOW ARROW MUST POINT UPWARD).
   j. Close the drain valve under the booster heater and turn the water supply ON checking for leaks at all fittings.
   k. Connect wiring to new pump motor and install wiring compartment cover.
   l. Purge the air from the system. Turn on the electrical supply and allow pump to displace air out of the heat exchanger and holding tank by running several rinse cycles on the dishwashing machine. Test all connections for tightness.
   m. Turn on gas supply (CHECK ALL FITTINGS FOR LEAKS) and follow start-up procedures.
6. Temperature/Pressure Gauge Replacement
   a. Shut off electrical power to the heater.
   b. Shut off water supply and open drain valve to remove water in the piping.
   c. Remove temperature/pressure gauge from pipe fitting connection.
   d. Reverse above procedure to re-install.
7. Temperature/Pressure Relief Valve Replacement
   a. Shut off electrical power to the heater.
   b. Shut off water supply and open drain valve to remove water in the tank below the relief valve level.
   c. Disconnect drain pipe from valve.
   d. Remove temperature/pressure relief valve.
   e. Reverse above procedure to re-install.
8. Low Water Cut Off Replacement
   a. Shut off electrical power to the heater.
   b. Remove screws for electronics cover and lift off.
   c. Mark wires and disconnect from old module.
   d. Reverse above procedure to re-install.
9. Tank High Limit Replacement
   a. Shut off electrical power to the heater.
   b. Shut off water supply and open drain valve to remove water in the piping and pump.
   c. Remove limit from mounting panel, disconnecting leads.
   d. Loosen 3/8" (9.5 mm) tank fitting packing nut then remove fitting.
   e. Reverse above procedure to re-install.
10. Orifice Replacement (for High Altitude Orifice Size Change or Orifice Repair)
    a. Shut off electrical power and gas supply to the heater.
    b. Remove front panel.
    c. Remove flexible gas line connector from gas regulator valve inlet.
    d. Remove burner tray assembly as outlined above.
    e. Loosen two (2) nuts on each burner bracket and lift burners out of the tray.
    f. Unscrew brass orifices from the black distribution manifold.
    g. Install new orifices as required.
    NOTE: If this is a high altitude change, refer to the tables in the HIGH ALTITUDE INSTALLATION & OPERATION section for the appropriate diameter to drill the orifice blanks for your elevation.
    h. Reverse the procedure above to re-install, checking burners and seals to prevent gas leaks.
11. Vent Outlet Adjustment to Right Side
    a. Shut off electrical power to the heater.
    b. Remove front panel.
    c. Remove both side panels by removing two screws on each panel from inside the cabinet. (Save these screws.)
    d. Remove five (5) screws holding the top of the back panel and two (2) nuts form below the front supports. (Save fasteners.)
    e. Clear wires from raceway clips and lift the top off the heater.

f. Remove three (3) screws holding the straight 90° elbow duct to the exhaust blower and pull duct out.
g. Remove three (3) screws holding the straight duct to the 90° elbow duct and separate. (Save the screws.)
h. Attach the straight duct to the discharge of the exhaust blower using the three (3) screws from Step g. Retain the 90° elbow duct for future relocation or discard.
i. Reassemble top and side panels in reverse order from above.
j. Remove vent hole cover from right side panel and place on back panel before reinstalling side duct letting exhaust duct protrude.

12. Heat Exchanger Replacement
    a. Shut off gas supply.
    b. Shut off electrical supply.
    c. Shut off water supply.
    d. ALLOW UNIT TO COOL DOWN TO ROOM TEMPERATURE.
    e. Open the drain valve under the booster heater to remove water from the tank and pump assembly.
    f. Disconnect water, gas, and relief valve plumbing as needed to access the booster.
    g. Remove front cover, sides, top and rear panel to access the heat exchanger.
    h. Remove the drain plug located on the front of the heat exchanger (do not discard) and allow the water to drain from the heat exchanger into a pan or receptacle. Exchanger holds approximately 16 oz. (498 g).
    i. Mark and remove the two (2) water fittings and discard old gaskets (new ones are provided), then position flexible lines away from harm.
    j. Carefully remove insulation from around the heat exchanger and set aside.
    k. Remove the perimeter screws from flue vent collection hood and carefully lift fan with vent collector hood off of the top of the heat exchanger. Disconnect fan wires if you cannot set the hood in a secure nearby location.
    l. Remove wires from high limit switch and then remove two (2) screws that hold switch to exchanger.
    m. Remove screws that hold the heat exchanger to combustion chamber and lift exchanger away. Discard old gasket between exchanger and combustion chamber (new part provided).
    n. Place new gasket o combustion chamber and position new heat exchanger on top. Fasten exchanger to combustion chamber with screws removed earlier.
    o. Place new gasket on top flange of heat exchanger and replace vent collector with power vent fan on top of new exchanger (reconnect wires if needed) securing with original screws.
    p. Replace insulation around the heat exchanger and fasten in place with high temperature aluminum tape.
    q. Attach high limit switch to exchanger with screws previously removed, and then attach wire leads to switch.
    r. Place new gaskets (provided) onto water fittings and carefully tighten flexible lines making sure they are oriented for proper flow.
    s. Seal threads of drain plug with a food grade sealant to prevent leakage and install in new exchanger.
    t. Reconnect water and gas lines and relief valve plumbing.
    u. Close drain valve under booster heater and turn on water supply to booster, then turn on electrical supply and allow pump to displace trapped air out of the new heat exchanger, then purge this air out of the booster by running several rinse cycles on the dishwashing machine. CHECK ALL FITTINGS FOR LEAKS.
    v. Turn on gas supply (CHECK ALL FITTINGS FOR LEAKS) and follow start-up procedures.

13. Blended Phosphate Water Treatment Cartridge Replacement
    a. Shut off electrical power to the heater.
    b. Shut off water supply and open drain valve to remove water in piping.
    c. Loosen canister using wrench attached.
    d. Remove canister and discard depleted cartridge.
    e. Use a clean damp cloth, wipe interior of canister clean.

    NOTE: Make sure O-ring seal is properly placed in canister.

    f. Reverse above procedure to reinstall.

MAINTENANCE

⚠ WARNING

Genuine Hatco Replacement Parts are specified to operate safely in the environments in which they are used. Some aftermarket or generic replacement parts do not have the characteristics that will allow them to operate safely in Hatco equipment. It is essential to use Hatco Replacement Parts when repairing Hatco equipment. Failure to use Hatco Replacement Parts may subject operators of the equipment to hazardous electrical voltage, resulting in electrical shock or burn.

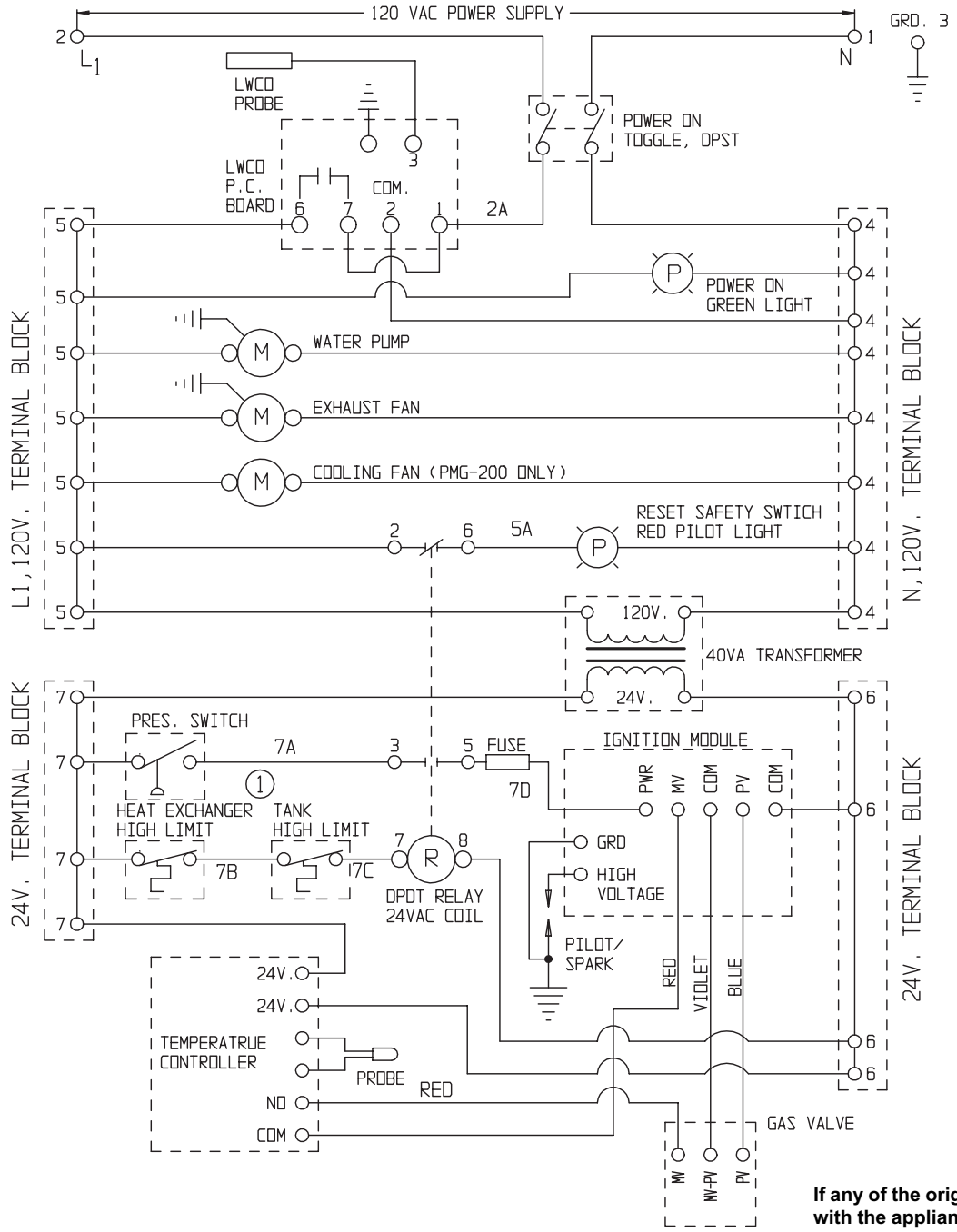
⚠ WARNING

This product has no "user" serviceable parts. To avoid damage to the unit or injury to personnel, use only Authorized Hatco Service Agents and Genuine Hatco Parts when service is required.

⚠ WARNING

If service is required on this unit, contact your Authorized Hatco Service Agent, or contact the Hatco Service Department at 800-558-0607 or 414-671-6350; fax 800-690-2966 or International fax 414-671-3976.

WIRING DIAGRAM



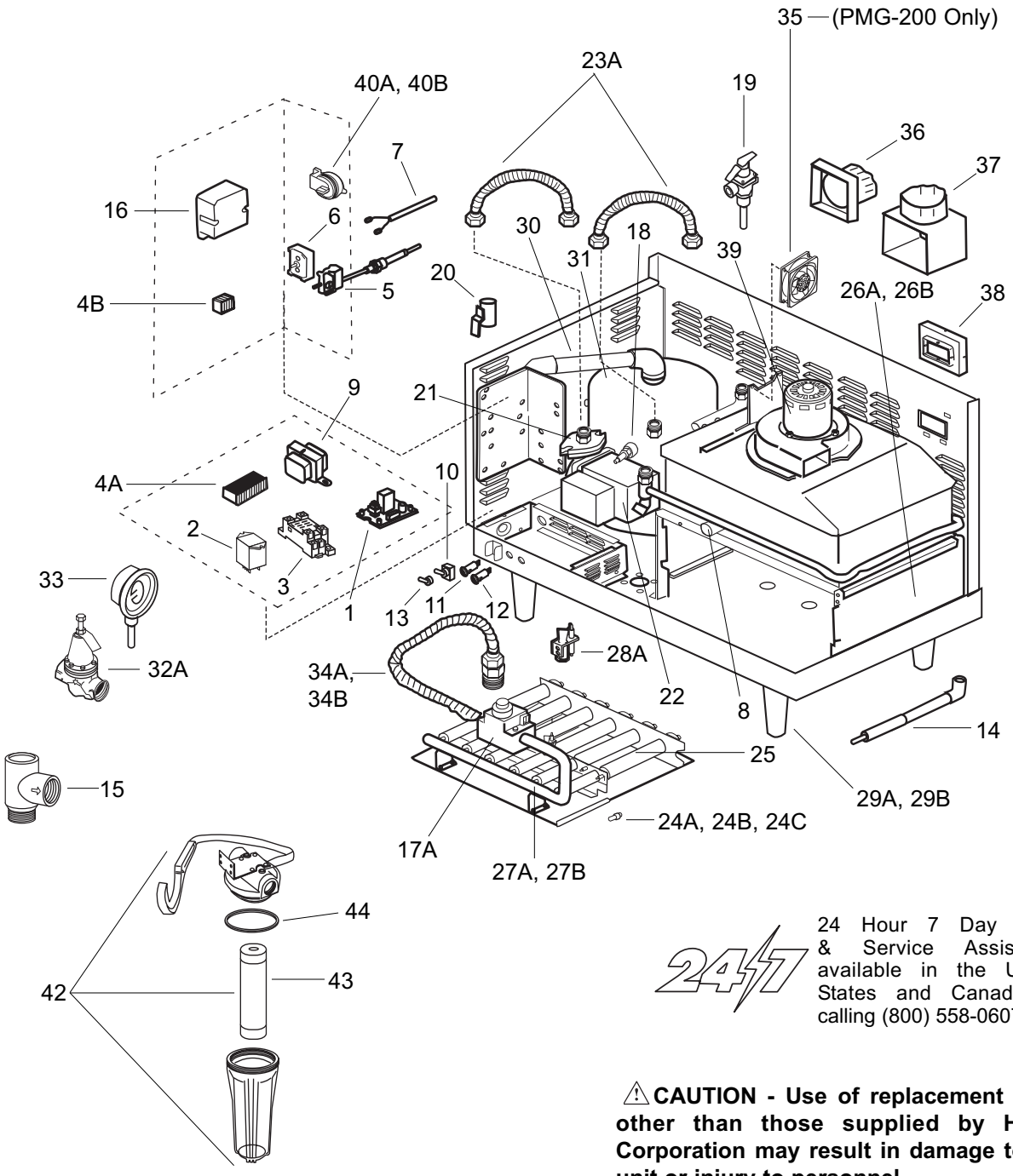
If any of the original wire as supplied with the appliance must be replaced, it must be replaced with 16 AWG 90°C (194°F) wire or its equivalent. For field-wired connections, use No. 16 AWG wires rated for at least 90°C (194°F).

Si un des conducteurs utilise sur le terrain ou d'origine fourni avec l'appareil doit etre remplace, il doit etre remplace par un conducteur' 16 AWG 90°C., ou l'equivalent.

REPLACEMENT PARTS LIST

HATCO POWERMITE®
PMG-100 and PMG-200
GAS BOOSTER HEATER

Model Designation
PMG-XXX
- P = Power
- M = Mite
- G = Gas
- X = Input BTUs/Hour (Approximate)



24 Hour 7 Day Parts & Service Assistance available in the United States and Canada by calling (800) 558-0607.

⚠ CAUTION - Use of replacement parts other than those supplied by Hatco Corporation may result in damage to the unit or injury to personnel.

PARTS COMMON TO ALL PMG-100 & PMG-200 MODELS

ITEM	DESCRIPTION	PART NO.	QTY.	ITEM	DESCRIPTION	PART NO.	QTY.
1	Low Water Cut Off Board 120V	R02.01.210.00	1	26B	Heat Exchanger (PMG-200)	R03.12.017B.00	1
2	Relay 24VAC Relay DPDT	02.01.116.00	1	27A	Gas Manifold (PMG-100)	03.12.015.00	1
3	Socket for Mini Relay	02.01.125.00	1	27B	Gas Manifold (PMG-200)	03.12.019.00	1
4A	Sectional T-Block 30P Control	02.15.032.00	1	28A	NAT Gas Pilot Assembly		
4B	Sectional T-Block 8P Distribution	02.15.033.00	1		with Orifice	03.12.010.00	1
5	Tank High Limit, Manual Reset	02.16.116.00	1	28B	LP Pilot Conversion Orifice*	03.12.011.00	1
6	Control Thermostat with Probe	R02.16.068.00	1	29A	6" (152 mm) Plastic Legs★	05.30.069.00	4
7	Temperature Control Probe	R02.16.069.00	1	29B	6" (152 mm) Stainless Legs★	05.30.070.00	4
8	Heat Exchanger High Limit	02.16.106.00	1	30	Heat Trap Assembly	AS.141.00	1
9	Transformer 120/24V (40VA)	02.17.034.00	1	31	Tempering Tank	01.05.005.00	1
10	Toggle Switch DPST	R02.19.008A.00	1	32A	Pressure Reducing Valve, Iron	03.02.004.00	1
11	Indicator Light, Green 120 Volt	02.19.070G.00	1	32B	Pressure Reducing Valve,		
12	Indicator Light, Red 120 Volt	02.19.070R.00	1		Brass* (Optional)	03.02.015.00	1
13	Boot Cover, Toggle Switch	02.20.040.00	1	33	Temperature Pressure		
14	Pilot Spark Cable, High Voltage	02.21.026.00	1		Gauge	03.01.003.00	2
15	Back Pressure Relief Valve			34A	Flexible Gas Line		
	(Optional)	03.02.039.00	1		(PMG-100)	03.12.014.00	1
16	Ignition Module	R02.21.022.00	1	34B	Flexible Gas Line		
17A	Natural Gas Combination Valve	02.21.025.00	1		(PMG-200)	03.12.018.00	1
17B	LP Gas Conversion Kit*	02.21.024.00	1	35	Cooling Fan		
18	Low Water Cut Off Probe	02.40.001.00	1		(PMG-200 Only)	02.12.008A.00	1
19	T/P Relief Valve	03.02.022.00	1	36	Straight Exhaust Adapter	04.28.052.00	1
20	Manual Shut Off Valve	03.02.027.00	1	37	Right Angle Exhaust		
21	Pump Flange Kit with Bolts	03.05.026.00	1		Adapter	04.28.053.00	1
22	Recirculating Pump	R03.05.052.00	1	38	Exhaust Outlet Box	R04.28.077.00	1
23A	Flexible Water Lines†	03.05.049.00	2	39	Exhaust Blower	R02.12.052.00	1
23B	Water Line Gasket*	05.06.066.00	4	40A	Pressure Switch (PMG-100)	02.21.027.00	1
24A	NAT Gas Orifice #34 (PMG-100)	03.12.016.00	3	40B	Pressure Switch (PMG-200)	02.21.028.00	1
24B	NAT Gas Orifice #35 (PMG-200)	03.12.020.00	6	41	LP Gas Conversion Kit		
24C	LP Gas Orifice #50				(Includes LP Gas Valve,		
	(PMG 100/200)	03.12.021.00	3/6		Orifices and Pilot)*	R00.02.0005.00	1
24D	High Altitude Blank			42	Water Treatment Canister		
	Orifice Kit*	R03.12.023.00	1		and Cartridge	03.05.061.00	1
25	Burner Tube (PMG-100/200)	03.12.012.00	3/6	43	Cartridge Only	03.05.061A.00	1
26A	Heat Exchanger (PMG-100)	R03.12.013B.00	1	44	O-Ring Gasket	03.05.061B.00	1

* *Not Shown*

★ *Units manufactured in the month of July 1999 or before use part number 04.01.013.00 for the replacement leg.*

† *Gasket should be replaced at each joint being serviced using Item #22B. Order Kit Item 41 when converting units to LP gas.*

NOTE: Consult factory if replacing Orifices or Burner Assembly to ensure proper sizing.

NOTE: When calling for parts/service, please supply altitude of installation location and fuel type.

NOTE: The last four digits in a ten digit numerical serial number is the manufacturing date code.
Example: Serial number 1021059907 has a date code of 9907 which indicates the following: 9907
Year 1999
Month seven, July

Please also note, effective January 2001 the serial number date code was changed to reflect the year and week of manufacture.
Example: xxxxxx 0124
Year 2001
Week twenty-four

HATCO LIMITED WARRANTY

1. PRODUCT WARRANTY

Hatco warrants the products that it manufactures (the "Products") to be free from defects in materials and workmanship, under normal use and service, for a period of one (1) year from the date of purchase when installed and maintained in accordance with Hatco's written instructions or 18 months from the date of shipment from Hatco. Buyer must establish the product's purchase date by returning Hatco's Warranty Registration Card or by other means satisfactory to Hatco in its sole discretion.

Hatco warrants the following Product components to be free from defects in materials and workmanship from the date of purchase (subject to the foregoing conditions) for the period(s) of time and on the conditions listed below:

a) **One (1) Year Parts and Labor PLUS One (1) Additional Year Parts-Only Warranty:**
Toaster Elements (metal sheathed)
Drawer Warmer Elements (metal sheathed)
Drawer Warmer Drawer Rollers and Slides
Food Warmer Elements (metal sheathed)
Display Warmer Elements (metal sheathed air heating)
Holding Cabinet Elements (metal sheathed air heating)

b) **One (1) Year Parts and Labor PLUS Four (4) Years Parts-Only Warranty on pro-rated terms that Hatco will explain at Buyer's request:**
3CS and FR Tanks

c) **One (1) Year Parts and Labor PLUS Nine (9) Years Parts-Only Warranty on:**
Electric Booster Heater Tanks
Gas Booster Heater Tanks

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR PATENT OR OTHER INTELLECTUAL PROPERTY RIGHT INFRINGEMENT. Without limiting the generality of the foregoing, SUCH WARRANTIES DO NOT COVER: Coated incandescent light bulbs, fluorescent lights, lamp warmer heat bulbs, glass components, Product failure in booster tank, fin tube heat exchanger, or other water heating equipment, caused by liming, sediment buildup, chemical attack or freezing, Product misuse, tampering or misapplication, improper installation or application of improper voltage.

2. LIMITATION OF REMEDIES AND DAMAGES

Hatco's liability and Buyer's exclusive remedy hereunder will be limited solely, at Hatco's option, to repair or replacement by a Hatco-authorized service agency (other than where Buyer is located outside of the United States, Canada, United Kingdom or Australia in which case Hatco's liability and Buyer's exclusive remedy hereunder will be limited solely to replacement of part under warranty) with respect to any claim made within the applicable warranty period referred to above. Hatco reserves the right to accept or reject any such claim in whole or in part. Hatco will not accept the return of any Product without prior written approval from Hatco, and all such approved returns shall be made at Buyer's sole expense. HATCO WILL NOT BE LIABLE, UNDER ANY CIRCUMSTANCES, FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR COSTS OR LOST PROFITS RESULTING FROM THE USE OF OR INABILITY TO USE THE PRODUCTS OR FROM THE PRODUCTS BEING INCORPORATED IN OR BECOMING A COMPONENT OF ANY OTHER PRODUCT OR GOODS.

NOTES

HATCO AUTHORIZED PARTS DISTRIBUTORS

ALABAMA

Jones McLeod Appl. Svc.
Birmingham 205-251-0159

ARIZONA

Auth. Comm. Food Equip.
Phoenix 602-234-2443

Byassee Equipment Co.
Phoenix 602-252-0402

CALIFORNIA

Industrial Electric
Huntington Beach 714-379-7100

Chapman Appl. Service
San Diego 619-298-7106

P & D Appliance
S. San Francisco 650-635-1900

COLORADO

Hawkins Commercial Appliance
Englewood 303-781-5548

DELAWARE

Food Equipment Service
Wilmington 302-996-9363

FLORIDA

Whaley Foodservice Repair
Jacksonville 904-725-7800

Universal Restaurant Services
Miami 305-593-5488

Nass Service Co., Inc.
Orlando 407-425-2681

B.G.S.I.
Pompano Beach 954-971-0456

Comm. Appliance Service
Tampa 813-663-0313

GEORGIA

TWC Services
Smyrna 770-438-9797

Heritage Service Group
Norcross 866-388-9837

Southeastern Rest. Svc.
Norcross 770-446-6177

HAWAII

Burney's Comm. Service, Inc.
Honolulu 808-848-1466

Food Equip Parts & Service
Honolulu 808-847-4871

ILLINOIS

Parts Town
Lombard 708-865-7278

Eichenauer Elec. Service
Decatur 217-429-4229

Midwest Elec. Appl. Service
Elmhurst 630-279-8000

Cone's Repair Service
Moline 309-797-5323

INDIANA

GCS Service
Indianapolis 317-545-9655

IOWA

Electric Motor Service Co.
Davenport 319-323-1823

Goodwin Tucker Group
Des Moines 515-262-9308

KENTUCKY

GCS Service
Louisville 502-367-1788

LOUISIANA

Chandlers Parts & Service
Baton Rouge 225-272-6620

MARYLAND

Electric Motor Service
Baltimore 410-467-8080

GCS Service
Silver Spring 301-585-7550

MASSACHUSETTS

Ace Service Co., Inc.
Needham 781-449-4220

MICHIGAN

Commercial Kitchen Service
Bay City 517-893-4561

Bildons Appliance Service
Detroit 248-478-3320

Midwest Food Equip. Service
Grandville 616-261-2000

MINNESOTA

GCS Service
Minneapolis 612-546-4221

MISSOURI

General Parts
Kansas City 816-421-5400

Commercial Kitchen Services
St. Louis 314-890-0700

Kaemmerlen Parts & Service
St. Louis 314-535-2222

NEBRASKA

Anderson Electric
Omaha 402-341-1414

NEVADA

Burney's Commercial
Las Vegas 702-736-0006

Hi. Tech Commercial Service
N. Las Vegas 702-649-4616

NEW JERSEY

Jay Hill Repair
Fairfield 973-575-9145

Service Plus
Flanders 973-691-6300

NEW YORK

Acme American Repairs, Inc.
Brooklyn 718-456-6544

Alpro Service Co.
Brooklyn 718-386-2515

Appliance Installation
Buffalo 716-884-7425

Northern Parts Dist.
Plattsburgh 518-563-3200

J.B. Brady, Inc.
Syracuse 315-422-9271

NORTH CAROLINA

Authorized Appliance
Charlotte 704-377-4501

OHIO

Akron/Canton Comm. Svc. Inc.
Akron 330-753-6635

Certified Service Center
Cincinnati 513-772-6600

Commercial Parts and Service
Columbus 614-221-0057

Electrical Appl. Repair Service
Independence 216-459-8700

E. A. Wichman Co.
Toledo 419-385-9121

OKLAHOMA

Hagar Rest. Service, Inc.
Oklahoma City 405-235-2184

Krueger, Inc.
Oklahoma City 405-528-8883

OREGON

Bressie Electric Co.
Portland 503-231-7171

Ron's Service, Inc.
Portland 503-624-0890

PENNSYLVANIA

Elmer Schultz Services
Philadelphia 215-627-5401

FAST Comm. Appl. Service
Philadelphia 215-288-4800

GCS Service
Pittsburgh 412-787-1970

K & D Service Co.
Harrisburg 717-236-9039

Electric Repair Co.
Reading 610-376-5444

RHODE ISLAND

Marshall Electric Co.
Providence 401-331-1163

SOUTH CAROLINA

Whaley Foodservice Repair
W. Columbia 803-791-4420

TENNESSEE

Camp Electric
Memphis 901-527-7543

TEXAS

Stove Parts Supply
Fort Worth 817-831-0381

Armstrong Repair Service
Houston 713-666-7100

Commercial Kitchen Repair Co.
San Antonio 210-735-2811

UTAH

La Monica's Rest. Equip. Service
Murray 801-263-3221

VIRGINIA

Daubers
Norfolk 757-855-4097

Daubers
Springfield 703-866-3600

WASHINGTON

Restaurant Appl. Service
Seattle 206-524-8200

WISCONSIN

A.S.C., Inc.
Madison 608-246-3160

A.S.C., Inc.
Milwaukee 414-543-6460

CANADA

BRITISH COLUMBIA

Key Food Equipment Service
Vancouver 604-433-4484

MANITOBA

Denko Mechanical Ltd.
Winnipeg 204-233-8003

ONTARIO

R.G. Henderson Ltd.
Toronto 416-422-5580

Choquette CKS
Ottawa 613-739-8458

QUÉBEC

Choquette CKS
Montreal 514-722-2000

Choquette CKS
Québec City 418-681-3944

HATCO CORPORATION
P.O. Box 340500, Milwaukee, WI 53234-0500 U.S.A.
(800) 558-0607 (414) 671-6350
Parts & Service Fax (800) 690-2966 Int'l. Fax (414) 671-3976
www.hatcocorp.com

Printed in U.S.A. August 2005 Part No. 07.04.244.00 Form No. PMG-100/200M-0805

Item # _____ C.S.I. Section 11420

OVENS

VC66G SERIES
DOUBLE DECK, DEEP DEPTH GAS CONVECTION OVENS



Model VC66GD
shown with optional casters

ENERGY STAR

SPECIFICATIONS

Double section, deep depth gas convection oven, Vulcan-Hart Model No. (VC66GD) (VC66GC). Stainless steel front, sides, top and legs. Independently operated stainless steel doors with double pane windows. Non-sag insulation applied to the top, rear, sides, bottom and doors. Porcelain enamel on steel oven interiors measures 29"w x 26⅛"d x 20"h. Two interior oven lights per section. Five nickel plated oven racks per section measure 28¼" x 24½". Eleven position nickel plated rack guides with positive rack stops. One 50,000 BTU/hr. burner per section. 100,000 BTU/hr. total input. Electronic spark igniters. Furnished with a two speed ½ H.P. oven blower-motor per section. Oven cool switch for rapid cool down. 120 volt, 60 Hz, 1 ph power supply required. 6' cord and plug. 7.7 amps total draw per section.

Exterior Dimensions:

40¼"w x 45⅛"d (includes motor & door handles) 41¾"d (includes motor only) x 70"h on 8" legs.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 2,000 FT.

- ☐ **VC66GD** Solid state temperature controls adjust from 150° to 500°F. 60 minute timer with audible alarm.
- ☐ **VC66GC** Computer controls with digital time and temperature readouts. 99-hour timer with audible alarm. Roast and Hold cycle. One hundred programmable menu selections. Shelf I.D. programming.

Double deck ovens are supplied as separate units with a stacking kit.

STANDARD FEATURES

- Stainless steel front, sides, top and legs.
- Independently operated stainless steel doors with double pane windows.
- 50,000 BTU/hr. burner per section. 100,000 BTU/hr. total input.
- Electronic spark igniters.
- ½ H.P. two speed oven blower-motor. 120/60/1 with 6' cord and plug. 7.7 amps per section. 15.4 amps total draw.
- Oven cool switch for rapid cool down.
- Porcelain enamel on steel oven interiors.
- Five nickel plated oven racks with eleven rack positions per section.
- ¾" rear gas connection with combination gas pressure regulator and safety solenoid system.
- One year limited parts and labor warranty.

OPTIONS

- ☐ Complete prison package.
  - ☐ Security screws only.
- ☐ 208V or 240V, 60 Hz, 1 ph, two speed, ½ H.P. blower motor. 208V, 4.2 amps; 240V, 3.6 amps.
- ☐ Casters.
- ☐ Simultaneous chain driven doors.
- ☐ Stainless steel rear enclosure.
- ☐ Second year extended limited parts and labor warranty.

ACCESSORIES

- ☐ Extra oven rack(s).
- ☐ Rack hanger(s).
- ☐ Stainless steel drip pan.
- ☐ Flexible gas hose with quick disconnect and restraining device. Consult price book for available sizes.
- ☐ Down draft flue diverter for direct vent connection.

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

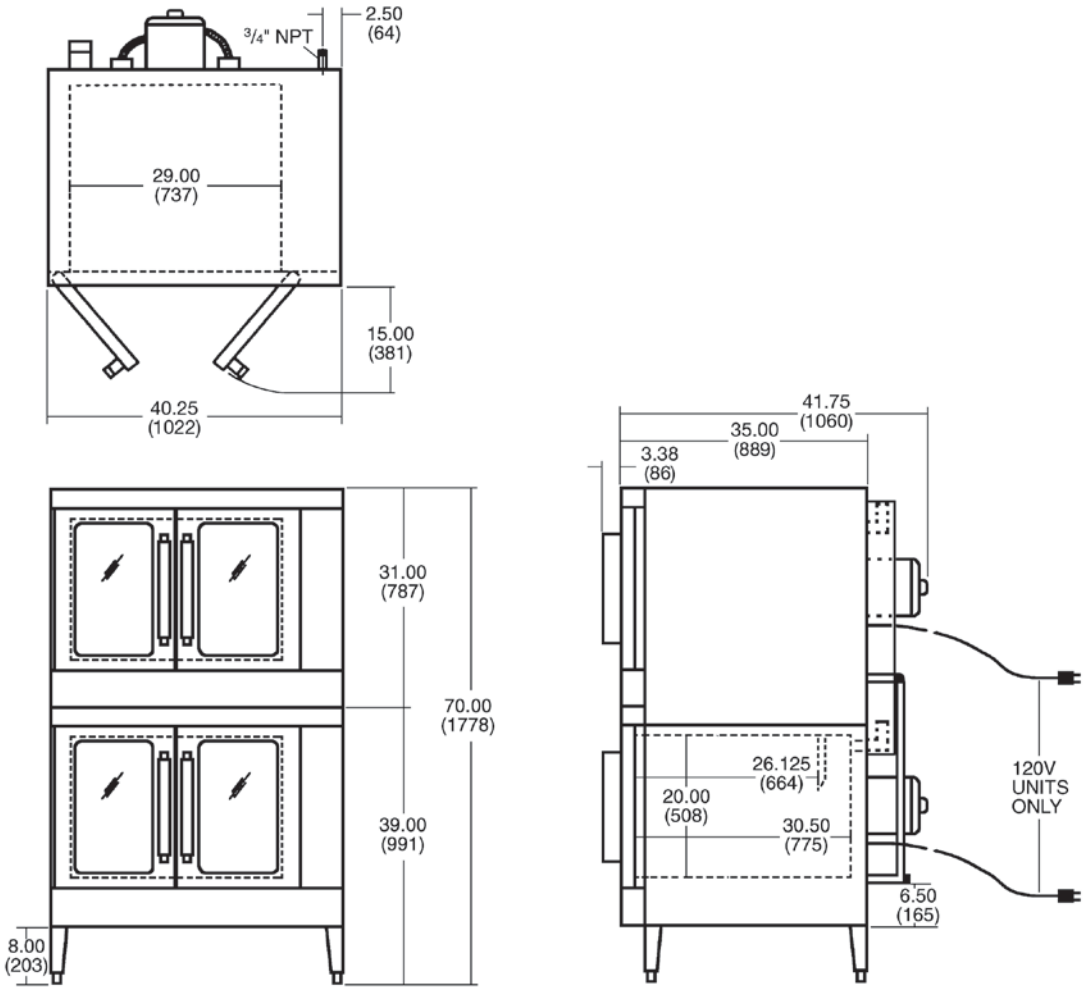
VC66G SERIES
DOUBLE DECK, DEEP DEPTH GAS CONVECTION OVENS

INSTALLATION INSTRUCTIONS

1. A combination gas pressure regulator and safety solenoid system is included in this unit. Natural gas is 5.0" W.C., Propane gas is 10.0" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02289. When writing, refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with ANSZ223.1 (latest edition), National Fuel Gas Code. Copies may be obtained from American Gas Association Inc., Accredited Standards Committee Z223, 400 N. Capitol St. NW, Washington, DC 20001 or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.
4. Clearances:

	Combustible	Non-combustible
Rear	0"	0"
Right Side	2"	0"
Left Side	1"	0"

5. This appliance is manufactured for commercial installation only and is not intended for home use.



MODEL NO.	WIDTH	DEPTH (INCLUDES HANDLES)	HEIGHT	BTU/HR. PER OVEN	TOTAL BTU/HR.	ELECTRICAL	WEIGHT			
							WITH SKIDS & PACKAGING		WITHOUT SKIDS & PACKAGING	
							LBS.	KG	LBS.	KG
VC66G	40¼"	45⅛"	70"	50,000	100,000	120/60/1	984	446	866	392

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

Printed On Recycled Paper

INTELLI-HOOD®



Melink®

Kitchen ventilation controls...that grow your bottom line

INTELLI-HOOD® Controls: The Industry Standard

The Melink Intelli-Hood controls are the industry standard for commercial kitchen ventilation systems. Mechanical engineers, foodservice consultants, energy service companies, and chain operators are specifying them on thousands of hoods for both new and existing facilities around the world.



Savings & Benefits

The Intelli-Hood controls reduce your exhaust and make-up fan speeds during idle, non-cooking conditions. **This yields fan energy savings of up to 90% and conditioned air savings of up to 50%. The result is a typical payback of 1- 3 years.**



More than 8,000 Installations Worldwide

Realizing the huge potential for fan energy and conditioned air savings, Melink pioneered the demand ventilation system for use in various food service facilities more than 20 years ago. Since then, we have completed more than 8,000 installations in:

- Restaurants
- Supermarkets
- Hotels
- K-12 Schools
- Colleges & Universities
- Hospitals
- Government Buildings
- Military Facilities
- Corporate Dining
- Clubs

Melink

Melink's patented technology is the difference - providing superior performance and energy savings



Note: The red line represents a infrared beam that detects smoke and vapors inside the hood, increasing the fan speed to 100% when necessary.

Intelli-Hood® Advantages

Melink pioneered demand ventilation controls for commercial kitchen hoods over 20 years ago, and has installed more than 8,000 systems worldwide over the years. Key advantages include:

- Optic Sensors allow a lower minimum speed for greater energy savings
- Optic Sensors ensure robust capture and containment of all smoke
- Plug and play cables eliminate installation problems
- Remote monitoring allows energy savings to be verified
- Intelligent algorithms provide automatic daily calibration
- Melink national network of trained technicians is best in industry

Melink®

INTELLI-HOOD® Saves up to 90% in Fan Energy and 50% in Conditioned Air

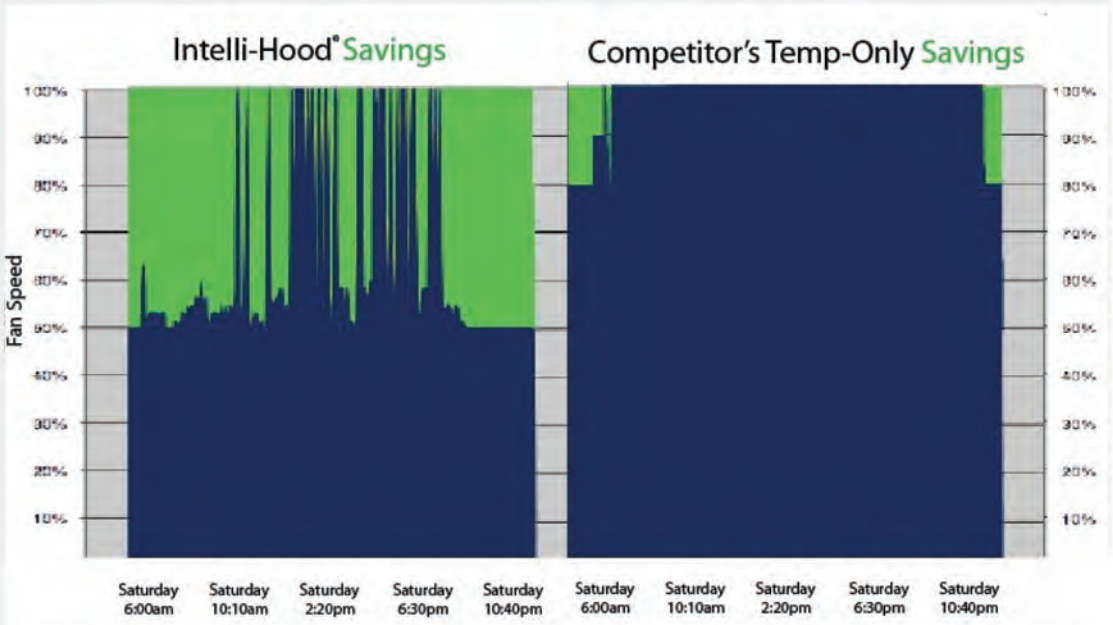
Most commercial kitchen hoods operate at 100% capacity all day long, even during idle, non-cooking conditions. Melink was the first to solve this industry problem through variable-speed control.

Actual Energy Savings

Typical Dinner House Restaurant

% Fan Speed

Energy Savings



Simple to Install & Operate

Intelli-Hood controls are easily installed on new hoods and retrofitted on existing hoods. The Temperature and Optic Sensors get mounted inside the hood/duct, and the Keypad, Processor, and Variable-Speed Drives typically get mounted in an end-cabinet or on a kitchen wall.

To operate, the cook/chef simply presses the light and fan switch on the Keypad, and the system begins operating. When the cooking appliances are turned on, the fan speeds increase based on the exhaust air temperature. During actual cooking, the speeds increase to 100% until the smoke/vapor is removed.



Melink's Intelli-Hood Keypad controls up to four hoods

Melink®

What Our Customers Say About INTELLI-HOOD®

"HEI Hotels and Resorts established its energy conservation guidelines that required all energy-saving renovations and upgrades deliver a ROI in three years or less. We achieved this goal by implementing standard energy-saving measures including the Melink Intelli-Hood kitchen exhaust control system."

- Bob Holesko, Vice President of Facilities for HEI Hotels and Resorts

"The best thing a hotel can do to reduce its environmental footprint is to reduce its energy use. The Melink Intelli-Hood system is one promising way to do so. Our Engineering Department working with the Engineers from each of our Hotel brands has fully evaluated Intelli-Hood and everyone is convinced that this is one of our most cost-effective paths to sustainability."

- Randy P. Gaines, Vice President Engineering Americas for Hilton Worldwide

"The day we started the hoods in the Wine Spectators Greystone Restaurant, the manager commented on how much the Melink system had improved the dining experience for the guests. In addition, the chef instructors commented that it was nice to talk and give cooking demos to the students with having not to yell over the noise of the hoods! The best part of installing the Intelli-Hood is the energy and money we are saving."

- Greg Phipps, Director of Facilities, Sodexo Education Facilities - The Culinary Institute of America at Greystone



Photo Courtesy of Greenheck Fan Corporation

Melink®

IH012011

About Melink



Melink Corporation is a provider of energy efficiency and renewable energy solutions for commercial and institutional facilities. The company offers building commissioning services, kitchen ventilation controls and solar PV systems.

Melink's corporate headquarters is LEED Platinum certified. It is also a Net-Zero Energy building making it one of the greenest buildings in the world.

To learn more about Melink, visit our website at www.melinkcorp.com.

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Melink®
Energy solutions for a brighter tomorrow™

Intellidyne®
The Power To Save

Refrigeration
Electrical Economizer



The *Intellidyne RU* will reduce electric consumption by 10% when installed on commercial refrigeration and freezer systems. *Intellidyne RU* is easily installed by a qualified installer, maintenance free, and guaranteed to save energy.

ENERGY STAR PARTNER

Features

- Dynamic Cycle Management© (DCM) technology is guaranteed to reduce electricity consumption by at least 10%.
- UL listed, "Energy Management Equipment".
- Increases savings without replacing or upgrading costly system components.
- LED indicators show operating modes.
- Protects compressor against momentary power outages and short cycling.
- Easy installation by a qualified installer.
- No programming or follow-up visits required.
- Maximum year-round efficiency.
- Reduces maintenance and extends compressor life.
- Fail-safe operation.
- 15-year replacement warranty for breakdowns or defects.

Intellidyne®
The Power To Save

Refrigeration

Electrical Economizer

Specifications

Mounting:
In any position via molded 1/2" electrical fitting
Size:
4"H x 4"W x 2 1/2"D
Operating Humidity:
5% - 95% Non-Condensing
Operating Temperature Range:
-10°F - +120°F
Power Input:
24/115/220 VAC @ 5W
Control Circuit:
24 VAC/DC, 115/220 VAC
Relay Contact:
10A @ 220VAC General Purpose
UL Listed,
"Energy Management Equipment"
Made in U.S.A.



The *Intellidyne RU* is a microprocessor-based, UL listed, electronic control that automatically adjusts the compressor cycles to achieve the greatest efficiency and reduced electrical usage.

The sizing of refrigeration systems is based on a number of factors. When any design considerations are not met, the refrigeration system is oversized for the load and thus less efficient. Intellidyne's patented process analyzes the demands and thermal characteristics of the entire refrigeration system to dynamically modify the compressor cycle pattern. These new patterns result in less frequent and more efficient compressor cycles.

The *Intellidyne RU* improves the electrical efficiency of refrigeration systems by supplementing the antiquated on/off action of the thermostat or pressuretrol with the analysis and control capabilities of a computer.

Intellidyne's patented process uses Dynamic Cycle Management® (DCM) technology to produce electrical energy savings. Our innovative and intelligent algorithms have field proven electrical savings on systems that were properly sized and operating, but also on units that were undersized, and those that had not been properly maintained.

The *Intellidyne RU* works in conjunction with the existing temperature controls, will not void the compressor manufacturer's warranty, and has anti-short-cycling.

Installation by a qualified service technician takes about 45 minutes. The *Intellidyne RU* does not require any programming, adjustments or maintenance.

Economical Efficient Ecological Easy

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Specification Sheet: T8 SEP LED Tubes

Retrofitting Is Easy with Our Energy Efficient Led Tubes

Our lightweight, shatterproof, all-plastic T8 Single-End-Power (SEP) LED tubes can reduce your lighting energy use by as much as 60% compared to fluorescent lights and provide a superior quality of light.

Our direct-wire UL Type-B design installs easily to operate from 120VAC to 277VAC, requires no ballast and is backed with our industry-leading 70,000-hour rated lamp life and 10-year warranty.

See Order Logic table below for our BAA/TAA-compliant products. Contact your Revolution Lighting representative for pricing or more information.

APPLICATIONS

- Offices & Commercial Buildings
- Retail Settings
- Hotels
- Schools
- Hospitals
- Warehouses
- Assisted Living Facilities
- Parking Garages
- Recreation Centers
- Food Processing Centers

ILLUMINATION ANGLE



Revolution Lighting Light Distribution

CAN DECREASE ENERGY USAGE BY



vs. Similar Fluorescent Lamps

WARRANTY



Our Industry-Leading 10-Year Limited Warranty Guarantees Unsurpassed Quality

PRODUCT BENEFITS

OPERATIONAL

- Very high efficacies up to 162 lm/W
- 3X greater lamp life than fluorescent, supported by industry-leading 10-year warranty
- 70,000 hour lamp life and eliminated ballast reduce long-term maintenance costs
- Instant on, no warm-up time

SAFETY

- No glass
- Negligible light depreciation over time
- UL Type B tube lamps are tested to comply with UL 1598C and UL 1993
- UL-rated for dry & damp locations
- Suitable for use in totally enclosed luminaires

SUSTAINABILITY

- Lack of UV or IR minimizes concerns with fading or discoloration
- Mercury-free, allowing for non-hazardous disposal
- 100% recyclable



ORDER LOGIC (Ex. SEPG4-24-8-FP-30-USA or SEPG4-24-8-FP-30)

Product Description		Length (in.)		Wattage		Lens		CCT (K Temp)		BAA/TAA
SEPG4 = Single-End-Power Gen. 4	–	24 = 2 ft	–	8 = 8W	–	FP = Frosted Plastic	–	30 = 3000K 35 = 3500K 40 = 4000K 50 = 5000K	–	Blank = Standard (non-BAA/TAA) USA = BAA (Buy American Act) A = TAA (Trade Agreement Act)
	–	36 = 3 ft	–	12 = 12W						
	–	48 = 4 ft	–	10.5 = 10.5W 12 = 12W 15 = 15W	–					

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For more information, visit **rvlti.com** or call **877-578-2536.**

Specification Sheet: T8 SEP LED Tubes

TECHNICAL DATA (Subject to change)

Catalog No.	Product SKU No.	BAA/ TAA Option*	Rated Wattage	Lens	Base	Input Voltage (VAC)	Color Temp (K)	Rated Lumens	Rated Efficacy	CRI	Illumination Angle	Rated Life (Hours)	Operating Temp. (°F)	NSF Listed
2-foot 8W G4 Single-End-Power LED Tube														
SEPG4-24-8-FP-30	202000-411	Yes	8	Frosted	G13	120-277	3000	1,100	137.5	83	312	70,000	-4 to 122	•
SEPG4-24-8-FP-35	202000-412	Yes	8	Frosted	G13	120-277	3500	1,100	138	83	312	70,000	-4 to 122	•
SEPG4-24-8-FP-40	202000-413	Yes	8	Frosted	G13	120-277	4000	1,100	138	83	312	70,000	-4 to 122	•
SEPG4-24-8-FP-50	202000-415	Yes	8	Frosted	G13	120-277	5000	1,100	138	83	312	70,000	-4 to 122	•
3-foot 12W G4 Single-End-Power LED Tube														
SEP-36-12-FP-30	203000-411	Yes	12	Frosted	G13	120-277	3000	1,440	120	83	312	70,000	-4 to 122	•
SEP-36-12-FP-35	203000-412	Yes	12	Frosted	G13	120-277	3500	1,440	120	83	312	70,000	-4 to 122	•
SEP-36-12-FP-40	203000-413	Yes	12	Frosted	G13	120-277	4000	1,440	120	83	312	70,000	-4 to 122	•
SEP-36-12-FP-50	203000-415	Yes	12	Frosted	G13	120-277	5000	1,440	120	83	312	70,000	-4 to 122	•
4-foot 10.5W G4 Single-End-Power LED Tube														
SEPG4-48-10.5-FP-30	204001-431	Yes	10.5	Frosted	G13	120-277	3000	1,700	162	83	312	70,000	-4 to 122	•
SEPG4-48-10.5-FP-35	204001-432	Yes	10.5	Frosted	G13	120-277	3500	1,700	162	83	312	70,000	-4 to 122	•
SEPG4-48-10.5-FP-40	204001-433	Yes	10.5	Frosted	G13	120-277	4000	1,700	162	83	312	70,000	-4 to 122	•
SEPG4-48-10.5-FP-50	204001-435	Yes	10.5	Frosted	G13	120-277	5000	1,700	162	83	312	70,000	-4 to 122	•
4-foot 12W G4 Single-End-Power LED Tube														
SEPG4-48-12-FP-30	204001-411	Yes	12	Frosted	G13	120-277	3000	1,700	142	83	312	70,000	-4 to 122	•
SEPG4-48-12-FP-35	204001-412	Yes	12	Frosted	G13	120-277	3500	1,700	142	83	312	70,000	-4 to 122	•
SEPG4-48-12-FP-40	204001-413	Yes	12	Frosted	G13	120-277	4000	1,700	142	83	312	70,000	-4 to 122	•
SEPG4-48-12-FP-50	204001-415	Yes	12	Frosted	G13	120-277	5000	1,700	142	83	312	70,000	-4 to 122	•
4-foot 15W G4 Single-End-Power LED Tube														
SEPG4-48-15-FP-30	204002-411	Yes	15	Frosted	G13	120-277	3000	2,100	140	83	312	70,000	-4 to 122	•
SEPG4-48-15-FP-35	204002-412	Yes	15	Frosted	G13	120-277	3500	2,100	140	83	312	70,000	-4 to 122	•
SEPG4-48-15-FP-40	204002-413	Yes	15	Frosted	G13	120-277	4000	2,100	140	83	312	70,000	-4 to 122	•
SEPG4-48-15-FP-50	204002-415	Yes	15	Frosted	G13	120-277	5000	2,100	140	83	312	70,000	-4 to 122	•

Product is DLC listed.

**Note: When ordering BAA- or TAA-compliant tubes, include the extension '-USA' or '-A' after the SKU No., respectively, as shown in the Order Logic table.*

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Specification Sheet: T8 SEP LED Tubes

PHYSICAL DATA

Catalog No.	Product SKU No.	Product Dimensions (in.)	Product Weight (lb)
2-foot 8W G4 Single-End-Power LED Tube			
SEPG4-24-8-FP-30	202000-411	24L x 1 Dia.	0.24
SEPG4-24-8-FP-35	202000-412	24L x 1 Dia.	0.24
SEPG4-24-8-FP-40	202000-413	24L x 1 Dia.	0.24
SEPG4-24-8-FP-50	202000-415	24L x 1 Dia.	0.24
3-foot 12W G4 Single-End-Power LED Tube			
SEP-36-12-FP-30	203000-411	36L x 1 Dia.	0.33
SEP-36-12-FP-35	203000-412	36L x 1 Dia.	0.33
SEP-36-12-FP-40	203000-413	36L x 1 Dia.	0.33
SEP-36-12-FP-50	203000-415	36L x 1 Dia.	0.33
4-foot 10.5W G4 Single-End-Power LED Tube			
SEPG4-48-10.5-FP-30	204001-431	48L x 1 Dia.	0.30
SEPG4-48-10.5-FP-35	204001-432	48L x 1 Dia.	0.30
SEPG4-48-10.5-FP-40	204001-433	48L x 1 Dia.	0.30
SEPG4-48-10.5-FP-50	204001-435	48L x 1 Dia.	0.30
4-foot 12W G4 Single-End-Power LED Tube			
SEPG4-48-12-FP-30	204001-411	48L x 1 Dia.	0.44
SEPG4-48-12-FP-35	204001-412	48L x 1 Dia.	0.44
SEPG4-48-12-FP-40	204001-413	48L x 1 Dia.	0.44
SEPG4-48-12-FP-50	204001-415	48L x 1 Dia.	0.44
4-foot 15W G4 Single-End-Power LED Tube			
SEPG4-48-15-FP-30	204002-411	48L x 1 Dia.	0.44
SEPG4-48-15-FP-35	204002-412	48L x 1 Dia.	0.44
SEPG4-48-15-FP-40	204002-413	48L x 1 Dia.	0.44
SEPG4-48-15-FP-50	204002-415	48L x 1 Dia.	0.44

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SINCE 1945 KEYSTONE | DIRECT DRIVE LED
LINE VOLTAGE T8 TUBES

WIRING HARNESS
RETROFIT ACCESSORIES

STRIP APPLICATIONS

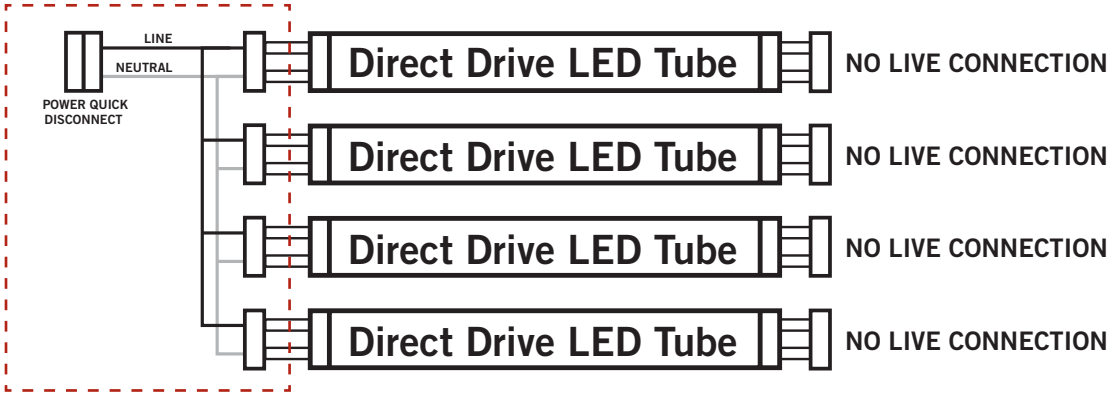
CATALOG NUMBER	DESCRIPTION
KT-SOCKET-T8-U-T-2-W	2-Lamp Wiring Harness for LED Tubes; Includes (2) Pre-Wired Tall, Non-Shunted Sockets with Power Quick Disconnect
KT-SOCKET-T8-U-T-3-W	3-Lamp Wiring Harness for LED Tubes; Includes (3) Pre-Wired Tall, Non-Shunted Sockets with Power Quick Disconnect
KT-SOCKET-T8-U-T-4-W	4-Lamp Wiring Harness for LED Tubes; Includes (4) Pre-Wired Tall, Non-Shunted Sockets with Power Quick Disconnect
KT-SOCKET-T8-U-T-6-W	6-Lamp Wiring Harness for LED Tubes; Includes (6) Pre-Wired Tall, Non-Shunted Sockets with Power Quick Disconnect

TROFFER APPLICATIONS

CATALOG NUMBER	DESCRIPTION
KT-SOCKET-T8-U-S-2-W	2-Lamp Wiring Harness for LED Tubes; Includes (2) Pre-Wired Standard, Non-Shunted Sockets with Power Quick Disconnect
KT-SOCKET-T8-U-S-3-W	3-Lamp Wiring Harness for LED Tubes; Includes (3) Pre-Wired Standard, Non-Shunted Sockets with Power Quick Disconnect
KT-SOCKET-T8-U-S-4-W	4-Lamp Wiring Harness for LED Tubes; Includes (4) Pre-Wired Standard, Non-Shunted Sockets with Power Quick Disconnect



WIRING DIAGRAMS



Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonelamp.com**

Specifications subject to change. Last revised on 6.22.16

ULTRA LED™ RT5/6 HO

Recessed Downlight Kit



SYLVANIA ULTRA RT5/6 HO is a universal input voltage 5" and 6" compatible LED recessed downlight kit that creates high performing white light and is optimized for new construction and retrofit applications utilizing pin based compact fluorescent lamps. Installation is done quickly and easily in most standard six-inch frames.

The RT5/6 HO downlight is offered in 700 lumen, 900 lumen and 1500 lumen options and achieves up to 88 lumens per watt.

The RT5/6 HO is designed to deliver light output comparable to traditional 1x13W, 1x18W, 1x26W and 2x26W pin based compact fluorescent luminaires.

Key Features & Benefits

- 120-277 universal input voltage
- Lumen package:
  - 700 lumens @ 8 watts (line voltage dimmable)
  - 900 lumens @ 13 watts (0-10V Dimmable)
  - 1500 lumens @ 17 watts (0-10V Dimmable)
- Replacement for 13W, 18W, 26W and 32W CFL pin based lamps
- Fits in standard 5" and 6" CFL mounting frame
- CCT: 2700K, 3000K, 3500K & 4000K
- CRI of >80
- 50,000 hour life (L_{70})
- Suitable for dry, damp and wet indoor or outdoor locations
- UL1598 Listed and Classified for stand-alone and retrofit applications
- Reduces energy consumption up to 34%
- Lasts up to 4 times longer than compact fluorescent lamps
- No warm-up time, instant-on with full light output and stable lamp to lamp color
- Integrated white trim and metal conduit adaptor (included) for direct replacement
- Suitable for use in 8" applications using optional trim extender accessory

Product Offering

Ordering Abbreviation	Wattage	CCT
LED/RT5/6/HO/700	8	2700K, 3000K, 3500K, 4000K
LED/RT5/6/HO/900	13	2700K, 3000K, 3500K, 4000K
LED/RT5/6/HO/1500	17	3000K, 3500K, 4000K

Application Information

Application Notes

1. Operating temperature range between -4°F and +104°F (-20°C and +40°C).
2. Suitable for dry, damp or wet indoor or outdoor locations.
3. Compatible with Philips Bodine ELI-S-20 Emergency Lighting Micro Inverter.
4. Designed to install in standard 6" CFL mounting frame. For a list of compatible housings, please refer to www.sylvania.com/RT6.
5. For detailed warranty information, please see www.sylvania.com/RT6.
6. The RT5/6HO 700 lumen is compatible with 120V Phase cut dimmers and 277V Leviton Dimmer model IPX06-70Z .
7. The RT5/6 HO 900 and 1500 lumen are compatible with Leviton 0-10V dimmer model IP710-DL.
8. For installation in non-insulated ceilings: If insulation is present, it may be placed around the retrofit kit as long as a three-inch space is maintained around the kit.
9. Installation performed as a stand-alone kit (without frame) is recommended for hard ceiling. Installation of a recessed incandescent frame (such as Lightolier model 1102P1) is recommended for tiled ceiling application for proper support of the retrofit kit.

Specifications and Certifications

SYLVANIA

Specification Data

Catalog #	Type
Project	
Comments	
Prepared by	

Specifications

Energy Data

Minimum Starting Temp: -20°C (-4°F)

EMI/RFI: RT6/HO 1500 lumen: FCC Title 47 CFR, Part 15, Class B
RT6/HO 900 lumen: FCC Title 47 CFR, Part 15, Class A

Sound Rating: <24dBA

Input Voltage: 120-277V

Power Factor: >0.90

Input Frequency: 60Hz

THD: <20%

Maximum Ambient Operating Temperature (Non-Insulated Ceiling): 40°C (104°F)

Lighting Data

Lumen Output: 700, 900 and 1500

Color

Color Rendering Index (CRI): >80

Ordering Information

Item Number	Ordering Abbreviation	Recessed Housing	Replaced CFL Wattage	Nominal Wattage (W)	Delivered Light Output (lm)	LPW	Avg. Color Temperature	Rated Life (hrs)*	Packaging Configuration	Dimmable
75228	LED/RT/5/6/HO/700/827	5" and 6"	13W	8	700	87	2700K	50,000	4/case	YES (Phase Cut)
75229	LED/RT/5/6/HO/700/830	5" and 6"	13W	8	700	87	3000K	50,000	4/case	YES (Phase Cut)
75230	LED/RT/5/6/HO/700/835	5" and 6"	13W	8	700	87	3500K	50,000	4/case	YES (Phase Cut)
75231	LED/RT/5/6/HO/700/840	5" and 6"	13W	8	700	87	4000K	50,000	4/case	YES (Phase Cut)
75137	LED/RT5/6/HO/900/827	5" and 6"	18W	13	900	69	2700K	50,000	4/case	YES (0-10V Low Voltage)
75138	LED/RT5/6/HO/900/830	5" and 6"	18W	13	900	69	3000K	50,000	4/case	YES (0-10V Low Voltage)
75140	LED/RT5/6/HO/900/835	5" and 6"	18W	13	900	69	3500K	50,000	4/case	YES (0-10V Low Voltage)
75139	LED/RT5/6/HO/900/840	5" and 6"	18W	13	900	69	4000K	50,000	4/case	YES (0-10V Low Voltage)
72528	LED/RT5/6/1500/HO/830	5" and 6"	26W & 32W	17	1500	88	3000K	50,000	4/case	YES (0-10V Low Voltage)
72529	LED/RT5/6/1500/HO/835	5" and 6"	26W & 32W	17	1500	88	3500K	50,000	4/case	YES (0-10V Low Voltage)
72530	LED/RT5/6/1500/HO/840	5" and 6"	26W & 32W	17	1500	88	4000K	50,000	4/case	YES (0-10V Low Voltage)

* LED lamp life is defined as the number of hours when 50% of an average group of identical lamps reached 70% of its initial lumens.

Ordering Guide

LED	/	RT5/6	/	1500	/	HO	/	8	30
LED		Product Name RT5/6 5/6 = fits 5" and 6" frames		Light Output 1500lm 900lm		High Output		CRI >80	Color Temperature 2700K, 3000K, 3500K, 4000K

Energy Savings

Basic Product Description	LED Lumens	LED Life	Traditional Lamp Types	Lumens	Life	Watts Saved With RT6	RT6 Energy Savings*	RT6 Life Benefit
RT5/6 HO 8W	700	50,000	13W CFL DD, DT	800	16,000	5	$27	3X
RT5/6 HO 13W	900	50,000	18W CFL DD, DT	1200	16,000	5	$27	3X
RT5/6/HO 17W	1500	50,000	26W CFL DD, DT	1800	16,000	9	$49	3X
RT5/6/HO 17W	1500	50,000	32W CFL DD, DT	2400	16,000	15	$82	3X

* Based on $0.11/kWh over 50,000 hours life.

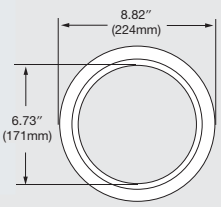
Accessories

RT5/6 Retrofit Trim	
75095	RT/5/6/TRIM/DKBZ
75097	RT/5/6/TRIM/BLK
75098	RT/5/6/TRIM/ORBZ
75099	RT/5/9/TRIM/SN
Trim Ring Extender	
75082	RT6/8/TRIMEXT


75097

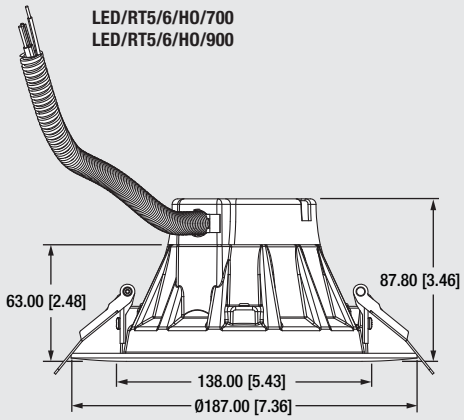

75098

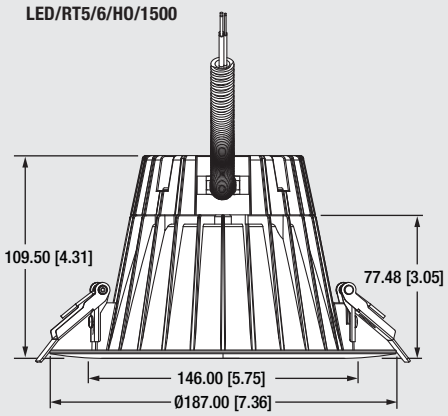

75099




75082

Assembly Diagram

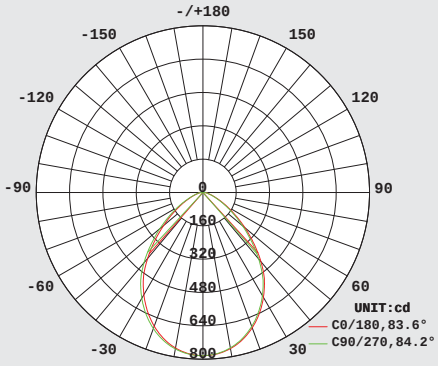




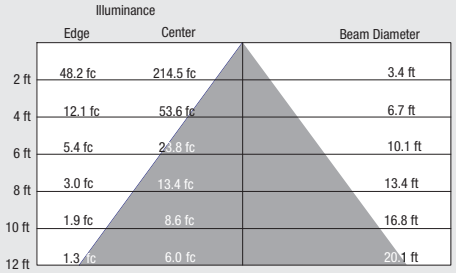
Dimensions are in mm [in]

Photometric Information

Luminous Intensity Distribution Diagram

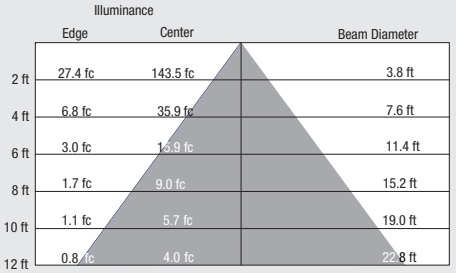


Illuminance at Distance



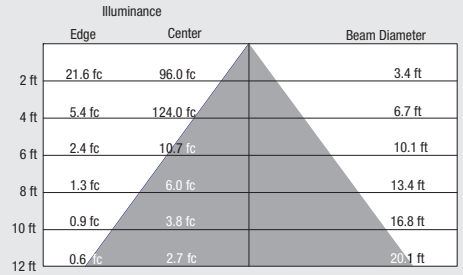
RT5/6 HO 1500 lumen

Illuminance at Distance



RT5/6 900 lumen

Illuminance at Distance



RT5/6 700 lumen

LEDVANCE LLC
200 Ballardvale Street
Wilmington, MA 01887 USA
Phone 1-800-LIGHTBULB (1-800-544-4828)
www.sylvania.com

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ULTRA LED™ RT8

Recessed Downlight Kit



The SYLVANIA ULTRA LED RT8 unit is an eight-inch LED recessed down-light kit creating high performing white light which is optimized for new construction and retrofit applications. Installation is done quickly and easily in most standard eight-inch frames.

Quality of Light

The SYLVANIA ULTRA LED RT8 provides excellent color rendering (up to 90 CRI), and a wide selection of color temperatures (3000K, 3500K, 4000K, 5000K). LEDs have virtually no UV or infrared radiation to damage or fade furnishings, art or other objects.

Optical Design

Optical design efficiently directs light output in an 80° beam angle with low glare.

Key Features & Benefits

- Lumen Package:
  2000 lumens @ 27W (120/277V)
  2000 lumens @ 23W (347V)
  3000 lumens @ 40W (120/277V)
  5000 lumens @ 54W (120/277V)
- Replacement for 32W and 42W CFL pin base lamps
- Fits in standard 8" CFL mounting frame
- CCT: 3000K, 3500K, 4000K, 5000K (see offerings below)
- CRI of up to 90
- 50,000 hour life (L_{70})
- Suitable for dry, damp and wet locations
- UL1598 Listed and Classified for stand-alone and retrofit applications
- 0-10V dimmable (3000lm only)
- Reduces energy consumption up to 50%
- 120/277V or 347V input voltage
- Lasts up to 3 times longer than CFL pin base lamps
- No warm-up time, instant-on with full light output and stable lamp to lamp color
- Integrated white trim, white baffle reflector and metal conduit adaptor (included) for direct replacement
- Suitable for use in 10" applications using optional trim extender accessory

Product Offering

Ordering Abbreviation	Wattage	Color Temperature	CRI
LED/RT8/2000	27	3000K, 3500K, 4000K	82
LED/RT8/2000-347V	23	3000K, 4000K, 5000K	82
LED/RT8/3000	40	3000K, 3500K, 4000K	90
LED/RT8/5000	54	3000K, 3500K, 4000K	82

Application Information

Applications

- Healthcare
- Hospitality
- Office
- Property Management
- Residential
- Retail

Specifications and Certifications

RoHS compliant · Lead-Free · Hg · ETL Classified · Intertek · FC · ENERGY STAR · lighting facts · 2014 Progress Report Selection

SYLVANIA

Specification Data

Catalog #	Type
Project	
Comments	
Prepared by	

Specifications

Energy Data

Minimum Starting Temp: 0°C to -20°C (32°F to -4°F)

EMI/RFI: FCC Title 47 CFR, Part 15, Class B

Sound Rating: <24dBA

Input Voltage: 120-277V & 347V

Power Factor: >0.90

Input Frequency: 60Hz

THD: <20%

Input Power: 23W, 27W, 40W, 54W

Maximum Ambient Operating Temperature (Non-Insulated Ceiling): 40°C (104°F)

Lighting Data

Lumen Output: 2000, 3000, 5000

Lumens per Watt: Up to 86

Color

Correlated Color Temperature (CCT): 3000K, 3500K, 4000K, 5000K

Color Rendering Index (CRI): 82, 90

R9: 15

Product Weight: 2.3 lbs.

Ordering Information

Item Number	Ordering Abbreviation	Input Voltage (V)	Recessed Housing	Replaced CFL Wattage	Nominal Wattage (W)	Delivered Light Output (lm)	LPW	Color Temperature	CRI	Avg. Rated Life (hrs.)*	Dimmable
72503	LED/RT8/2000/830	120/277	8"	2X26W 1X42W	27	2000	74	3000K	82	50,000	No
72504	LED/RT8/2000/835	120/277	8"	2X26W 1X42W	27	2000	74	3500K	82	50,000	No
72509	LED/RT8/2000/840	120/277	8"	2X26W 1X42W	27	2000	74	4000K	82	50,000	No
75397	LED/RT8/2000/830/347V	347	8"	2X26W 1X42W	23	2000	86	3000K	82	50,000	No
75398	LED/RT8/2000/840/347V	347	8"	2X26W 1X42W	23	2000	86	4000K	82	50,000	No
75399	LED/RT8/2000/850/347V	347	8"	2X26W 1X42W	23	2000	86	5000K	82	50,000	No
72625	LED/RT8/3000/930	120/277	8"	2X32W	40	3000	75	3000K	90	50,000	Yes (0-10V Low Voltage)
72626	LED/RT8/3000/935	120/277	8"	2X32W	40	3000	75	3500K	90	50,000	Yes (0-10V Low Voltage)
72628	LED/RT8/3000/940	120/277	8"	2X32W	40	3000	75	4000K	90	50,000	Yes (0-10V Low Voltage)
79740	LED/RT8/5000/830	120/277	8"	2X42W	54	5000	92	3000K	82	50,000	Yes (0-10V Low Voltage)
79741	LED/RT8/5000/835	120/277	8"	2X42W	54	5000	92	3500K	82	50,000	Yes (0-10V Low Voltage)
79742	LED/RT8/5000/840	120/277	8"	2X42W	54	5000	92	4000K	82	50,000	Yes (0-10V Low Voltage)

* LED lamp life is defined as the number of hours when 50% of an average group of identical lamps reached 70% of its initial lumens.

Ordering Guide

LED	/	RT8	/	2000	/	8	30	/	347V
LED		Product Name RT8 8 = fits 8" frames		Light Output 2000lm, 3000lm, 5000lm		CRI >80	Color Temperature 3000K, 3500K, 4000K		Input Voltage 347V

Energy Savings

Basic Product Description	LED Lumens	LED Life	Traditional Lamp Type	Lumens	Life	Watts Saved With RT8	RT8 Energy Savings*	RT8 Life Benefit
RT8 27W	2000	50,000	Compact Fluorescent	2400	16,000	Up to 15	$82.50	3X
RT8 23W	2000	50,000	Compact Fluorescent	2400	16,000	Up to 19	$104.50	3X
RT8 40W	3000	50,000	Compact Fluorescent	2400	16,000	Up to 24	$132.00	3X
RT8 54W	3000	50,000	Compact Fluorescent	2400	16,000	Up to 30	$165.00	3X

* Based on $0.11/kWh over 50,000 hours life.

Accessories

RT8 Trim

75092	RT8TRIMALZAK
75093	RT8TRIMSN

Trim Ring Extender

75083	RT8/10/TRIMEXT



Alzak 75092

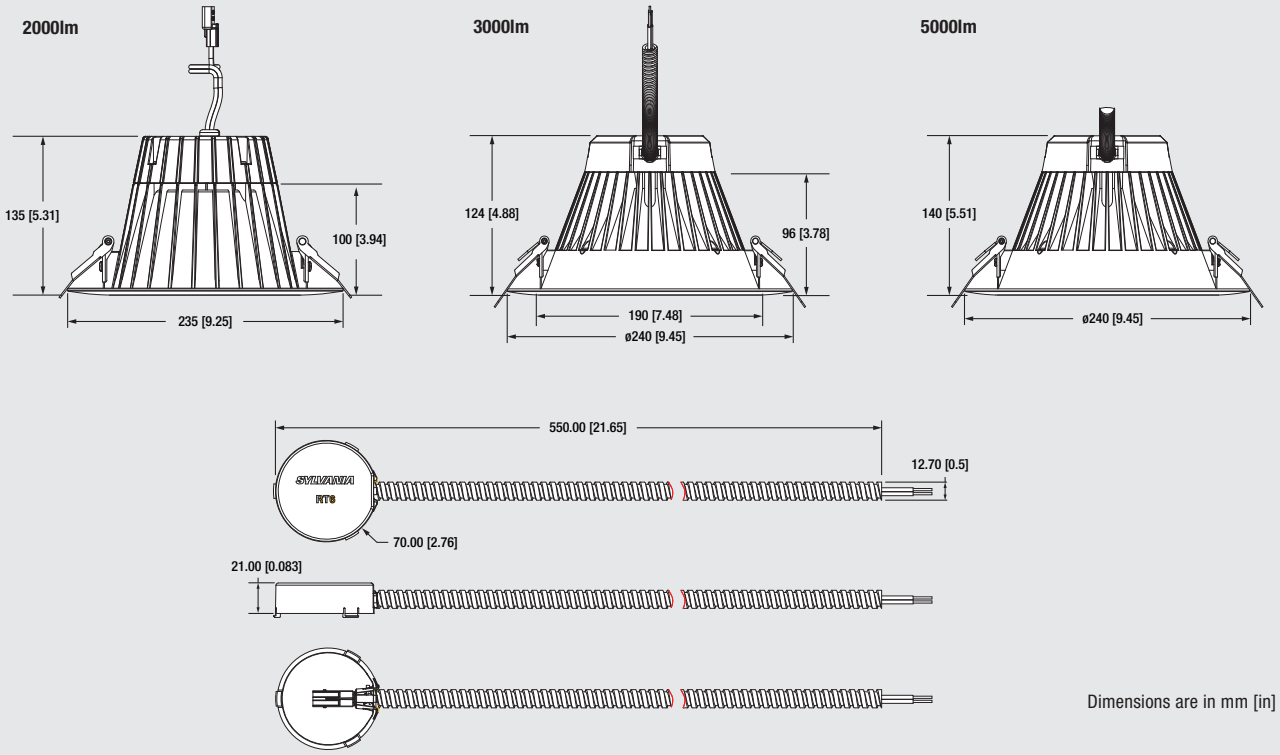


Satin 75093



75083

Assembly Diagram

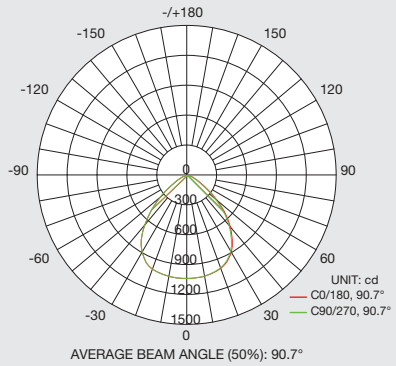


Dimensions are in mm [in]

Photometric Information

RT8 2000lm

Polar Chart

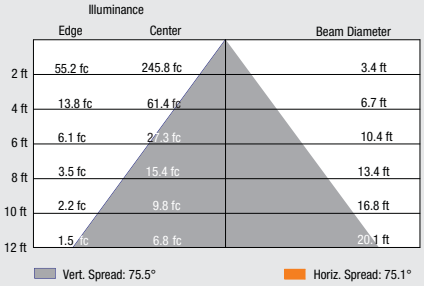


AVERAGE BEAM ANGLE (50%): 90.7°

Zonal Lumen Distribution

Zone	Lumens	% Retrofit Kit
0-20	384	19
0-30	822	41
0-40	1312	65
0-60	1943	97
0-80	2090	104
0-90	2106	105
10-90	2008	100
20-40	927	46
20-50	1330	66
40-70	734	3
60-80	146	67
70-80	43	2
80-90	16	0
0-180	2106	105

Illuminance at Distance

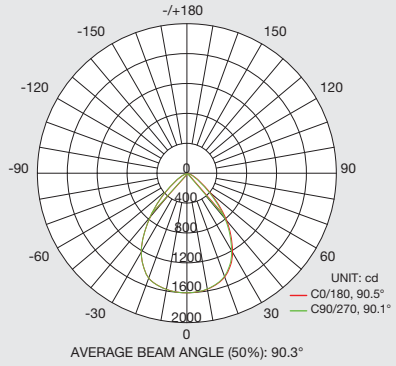


Spacing to Mounting Height Ratio

Spacing Criteria (0-180°)	1.16
Spacing Criteria (90-270°)	1.16
Spacing Criteria (Diagonal)	1.24

RT8 3000lm

Polar Chart

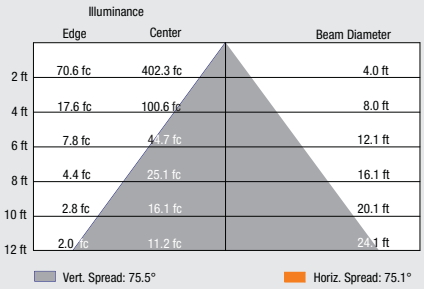


AVERAGE BEAM ANGLE (50%): 90.3°

Zonal Lumen Distribution

Zone	Lumens	% Retrofit Kit
0-20	576	17
0-30	1189	35
0-40	1871	56
0-60	2945	88
0-80	3289	98
0-90	3310	99
10-90	3159	95
20-40	1294	38
20-50	1916	57
40-70	1326	39
60-80	343	10
70-80	92	2
80-90	21	0.7
0-180	3326	100

Illuminance at Distance



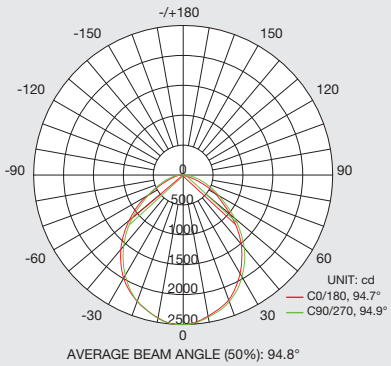
Spacing to Mounting Height Ratio

Spacing Criteria (0-180°)	1.14
Spacing Criteria (90-270°)	1.16
Spacing Criteria (Diagonal)	1.24

Photometric Information (continued)

RT8 5000lm

Polar Chart

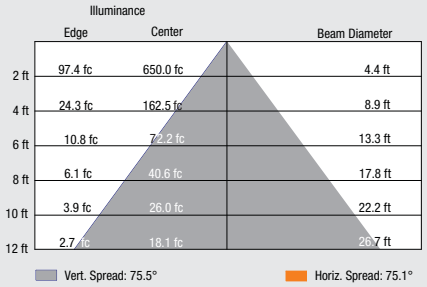


AVERAGE BEAM ANGLE (50%): 94.8°

Zonal Lumen Distribution

Zone	Lumens	% Retrofit Kit
0-20	930	16
0-30	1928	34
0-40	3061	54
0-60	4979	88
0-80	5618	99
0-90	5651	100
10-90	5407	95
20-40	2130	37
20-50	3211	56
40-70	2399	42
60-80	639	11
70-80	158	2
80-90	32	0.6
0-180	5651	100

Illuminance at Distance



Spacing to Mounting Height Ratio

Spacing Criteria (0-180°)	1.16
Spacing Criteria (90-270°)	1.16
Spacing Criteria (Diagonal)	1.26

Application Information

Application Notes

1. Operating temperature range between -4°F and +104°F (-20°C and +40°C).
2. Suitable for indoor/outdoor use, including dry, damp and wet location environments.
3. Designed to install in standard 8" CFL mounting frame. For a list of compatible housings, please refer to www.sylvania.com/RT8.
4. For detailed warranty information, please see www.sylvania.com/RT8.
5. For installation in non-insulated ceilings: If insulation is present, it may be placed around the retrofit kit as long as a three-inch space is maintained around the kit.
6. Installation performed as a stand-alone kit (without frame) is recommended for hard ceiling. Installation of a recessed incandescent frame is recommended for tiled ceiling application for proper support of the retrofit kit.
7. Compatible with Philips Bodine model ELI-S-20 and IOTA model IIS-125 Emergency Lighting Inverters.

LEDVANCE LLC
200 Ballardvale Street
Wilmington, MA 01887 USA
Phone 1-800-LIGHTBULB (1-800-544-4828)
www.sylvania.com

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Specifications subject to change without notice.

/sylvania /sylvania

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Catalog # :	Project :
Prepared By :	Date :

SDL8'
LED Strip Diffused Lens



The sleek architectural SDL is designed with tooless entry features saving time and money on installation. Optimizing industry leading LED technology, the SDL series delivers unparalleled performance and efficiency meeting stringent energy requirements. The frosted lens delivers high vertical illumination offering 3000K, 3500K, 4000K and 5000K color temperatures. Innovative programmable drivers offer expansive lumen packages and comes standard with 0-10V dimming down to 1%. Designed with uncompromised aesthetics, the high-performance luminaire is well suited for commercial, industrial, retail and residential applications.

Features & Specifications

Optical System

- High transmission custom extruded frosted acrylic radius lens eliminates bright spots from individual LED's and provides high vertical illumination and visual comfort.
- Use of closely spaced medium-power, high brightness chips minimizes pixilation and provides uniform lens luminance.
- Available in 5000K, 4000K, 3500K, and 3000K color temperatures per ANSI C78.377. Consult Factory for other color temperature requirements.
- Minimum CRI of 80.

Electrical

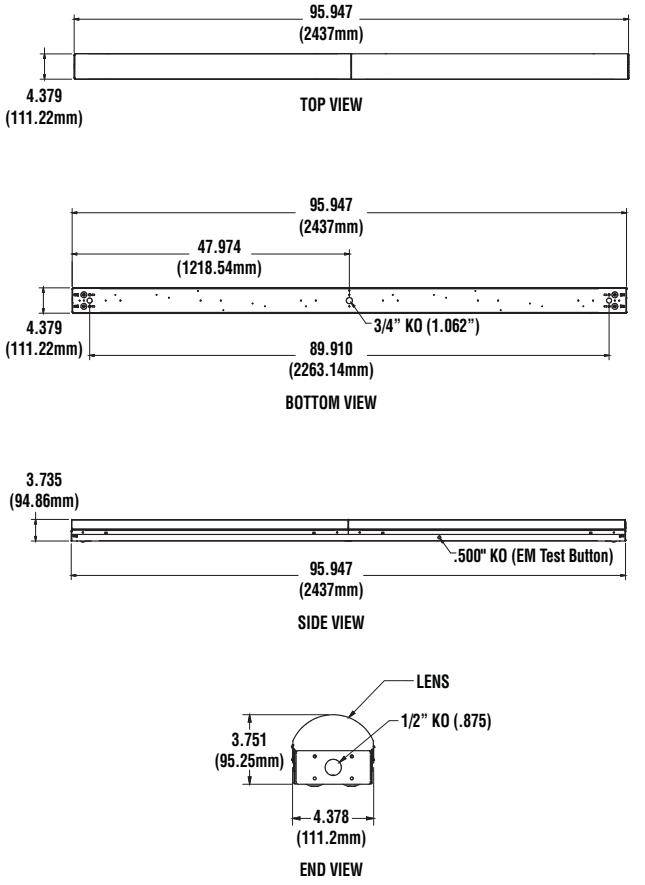
- Class 2 high-performance programmable driver features short circuit, open circuit protection for LED + and LED - and temperature foldback. Driver complies with FCC standards.
- 0-10 volt dimming (1% - 100%) standard.
- Standard Universal voltage (120-277 Vac) Input 50/60 Hz. Optional high Voltage 347 Vac Input available, consult factory for lead time and DLC® qualification information. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.
- L70 Calculated Life: >60k Hours @ 25°C per IESNA TM-21-11. (See Lumen Maintenance on Page 2)
- Total harmonic distortion: <20%
- Power factor: >.90
- Input power stays constant over life.
- Optional (120-277V) integral 10 watt battery backup is available. The 90-minute batteries provide constant power to the LED system. The fixture delivers 1300 lumens during emergency mode. A test switch/indicator button is installed in the housing for ease of maintenance.

Controls

- Optional Bolt-on integral passive infrared motion and/or daylight sensor activates switching of luminaire light levels (see page 5 for more details).
- Optional Step-level dimming driver allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

TITLE 24 COMPLIANT · ARRA Funding Compliant · c UL us LISTED · Dimmable · RoHS COMPLIANT · damp location · MANUFACTURED IN USA · QUICK SHIP · DLC PREMIUM

Dimensions



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Features & Specifications (cont.)

Construction

- Rigid housing is die-formed 22-gauge cold rolled steel for consistency and strength.
- Available for individual or continuous row mounting.
- Tool-less access by applying pressure/squeezing the ends of the electrical housing channel to remove the lens/light engine assembly to access the wireway chamber
- Luminaire is proudly manufactured in the U.S of U.S. and imported components.
- Luminaire is painted after fabrication following treatment with phosphate rust inhibitor. Finish coat of housing is high reflectance white (minimum 92%) polyester powder.
- Shipping weight: 18 lbs

Installation

- Suitable for surface, pendant, grid and chain mounting.
- Accepts optional plug-in wiring feature for continuous row installation.
- Alignment couplers furnished for continuous row installation.

Warranty

- LSI LED Fixtures carry a 5-year warranty.
- 1 Year warranty on optional Battery Backup. Test regularly in accordance with local codes.

Listing

- Listed to UL 1598 and UL 8750 for 25ºC Ambient applications
- RoHS Compliant.
- State of California Title 24 compliant with OCSUE/DHSUE option.
- American Recovery and Reinvestment Act Funding Compliant.
- Suitable For Damp Locations.

Photometry

- See website for IES and photometric files

Performance

SDL8 ELECTRICAL DATA (Amps)*

Lumen Package	120V	208V	240V	277V
70L	0.44A	0.25A	0.22A	0.19A
80L	0.51A	0.29A	0.25A	0.22A
100L	0.61A	0.35A	0.30A	0.26A
120L	0.75A	0.43A	0.37A	0.32A
140L	0.89A	0.51A	0.44A	0.38A
160L	1.03A	0.59A	0.52A	0.45A
180L	1.19A	0.68A	0.59A	0.51A

*Electrical data at 25C (77F). Actual wattage may differ by +/-10%.

Recommended Lumen Maintenance[1]

LUMENS	AMBIENT TEMP C	INITIAL[2]	25K HR[2]	50K HR[2]	75K HR[3]	100K HR[3]
80L	25C	98%	96%	95%	93%	91%
160L	25C	97%	91%	85%	80%	75%
180L	25C	97%	90%	83%	77%	71%

Specifications and dimensions subject to change without notice.

1 - Lumen maintenance values at 25C are calculated per TM-21 based on LM-80 data and in-situ testing.

2 - In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times the IESNA LM-80-08 total test duration for the device under testing

3 - In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times the IESNA LM-80-08 total test duration for the device under testing

*LED chips are frequently updated therefore values are subject to change.

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Performance (cont.)

SDL8 DELIVERED LUMENS*										
		3000K CCT		3500K CCT		4000K CCT		5000K CCT		
LUMEN PACKAGE	CRI	DELIVERED LUMENS	EFFICACY	DELIVERED LUMENS	EFFICACY	DELIVERED LUMENS	EFFICACY	DELIVERED LUMENS	EFFICACY	WATTAGE
70L	80	6885	130.6	7137	135.9	7018	134.2	7530	143.2	52.3
80L	80	7922	130.7	8212	135.5	8075	133.3	8664	143.0	60.6
100L	80	9809	134.5	10168	139.5	9998	137.1	10727	147.2	72.9
120L	80	11833	131.8	12267	136.6	12062	134.3	12942	144.1	89.8
140L	80	13779	129.7	14283	134.5	14045	132.3	15070	141.9	106.2
160L	80	15743	127.3	16319	131.9	16047	129.7	17218	139.2	123.7
180L	80	17678	124.2	18325	128.8	18019	126.6	19334	135.9	142.3

*LED chips are frequently updated therefore values are subject to change.

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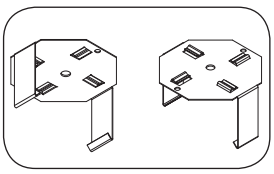
Luminaire Ordering Guide

TYPICAL ORDER EXAMPLE: **SDL8 LED 80L FL UNV DIM1 35 80CRI**

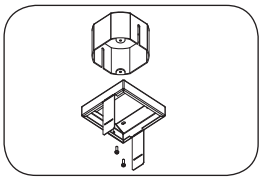
Family Size	LED Gen	Lumen Package	Lens	Voltage	Driver	Color Temp	CRI	Controls	Options	Packaging
SDL8- 8' Strip	**LED**	**70L** - 7000 **80L** - 8000 **100L** - 10000 **120L** - 12000 **140L** - 14000 **160L** - 16000 **180L** - 18000 *Consult factory for programmable wattages and lumen packages	**FL** Frosted Lens	**UNV** - 120-277v **347** - 347V[1]	**DIM1** - Dims to 1%(0-10V) **SD50** - Step dimming to 50%[2]	**30** - 3000K **35** - 3500K **40** - 4000K **50** - 5000K	**80CRI** - 80 CRI **90CRI** - 90 CRI[1]	**(Blank)** - None **OCSUE** - Occupancy Sensor 120-277V[2] **DHSUE** - Daylight harvesting/ Occupancy Sensor 120-277V[2]	**(Blank)** - None **EM10** - 10W Battery Backup (1300 Lumens)[2] **PM1** - 9FT Pre-wired plug in assembly (standard)[2] **PM1LV** - 9FT Pre-wired plug in assembly (0-10V Dimming)[2] **PM2** - 9FT Pre-wired plug in assembly (SD50 or EM10)[2] **PM2LV** - 9FT Pre-wired plug in assembly (SD50 or EM10 with 0-10V Dimming)[2]	**(Blank)** - Single Pack

NOTES:
1. Consult factory for leadtime & DLC qualifications.
2. Not available with 347V

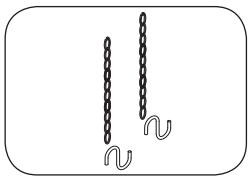
Accessory Ordering Information (Accessories are field installed)



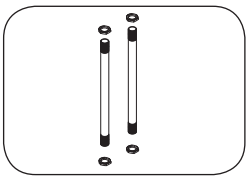
Description: T-Grid Hanger Kit
Order Number: (Qty 2) - 671560



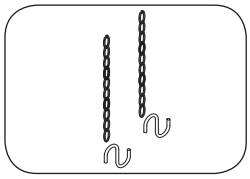
Description: T-Grid Collar (including junction box, wire collar & grid hanger)
Order Number: (Qty 1) - 558651



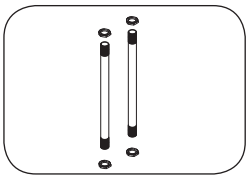
Description: Chain Hanger Set (36" length)
Order Number: (Qty 2) - M38258



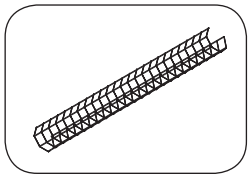
Description: 24" Pendant
Order Number: (Qty 1) - 687400



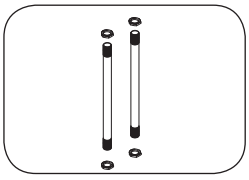
Description: Chain Hanger Set (60" length)
Order Number: (Qty 2) - 251057



Description: 36" Pendant
Order Number: (Qty 1) - 681509



Description: Wire Guard - 4 foot
Order Number: (Qty 2) - 549301



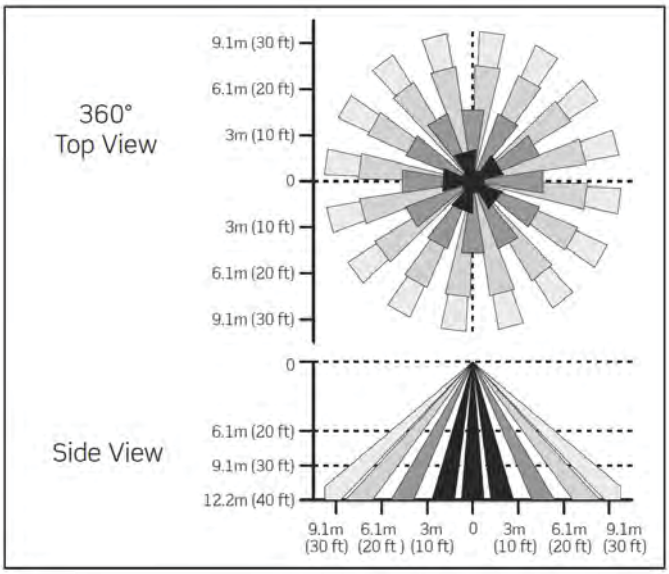
Description: 48" Pendant
Order Number: (Qty 1) - 687382

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Controls

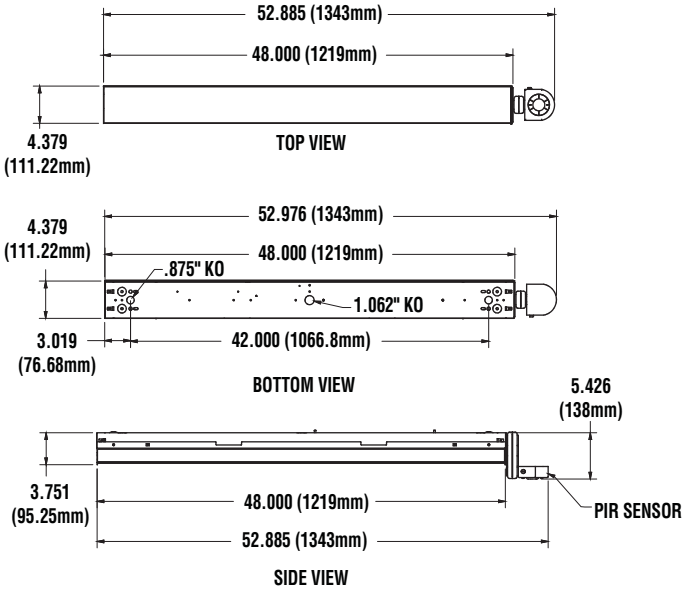
Occupancy Sensor (OCSUE)

- Optional integral passive infrared motion activates switching of luminaire on/off. Standard Factory settings: Luminaire is activated and increased to full bright upon detection of motion. Luminaire powers off when target zone is absent of motion activity for ~5 minutes. See coverage diagram for detection cone.



Occupancy Sensor / Daylight Sensor (DHSUE)

- Optional integral passive infrared motion and daylight sensor activates switching of luminaire on/off. Standard Factory settings: Luminaire is activated and increased to full bright upon detection of motion. Luminaire powers off when target zone is absent of motion activity for ~5 minutes. See coverage diagram for detection cone. Photocell turns off lights when sufficient amount of daylight is detected and turns lights on when additional lighting is required.

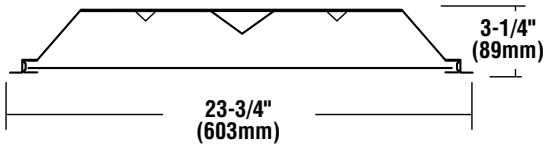


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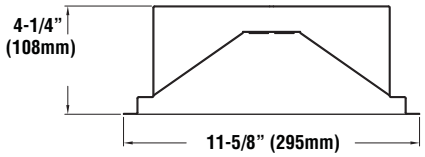
LED HIGH EFFICIENCY LENSED - P12 - STATIC (GA24, GA22, GA14)



DIMENSIONS



Pattern 12 Acrylic Standard



1 X 4

PRODUCT HIGHLIGHTS

- Long life, high brightness LEDs virtually eliminate maintenance.
- Cam action latches and die formed T-hinges for door insertion from either side.
- Die-formed flat steel door with mitered loK corners for clean appearance
- 3 ¼" deep housing

EXPECTED LIFE - Projected life of at least 60,000 hours. Contact factory for TM-21 detail.

LEDS - Use of closely-spaced medium-power, high-brightness chips minimizes pixelation and provides uniform lens luminance. Available in Cool White (5000K), Neutral White (4000K) and Warm White (3500K) color temperatures. CRI >= 80 (CW > 70). LM-80 reports available.

CONSTRUCTION - Housing constructed of structurally embossed, heavy gauge, cold rolled steel. Wireway cover snap in for easy attachment and removal. Access plate provides top access to wireway. Integral EQ grid clips included.

LENS - 0.095 Pattern 12 lens is standard. Pattern 12 .125 (nominal .125 thickness) available. Lens option must be specified in catalog string.

ELECTRICAL - Universal voltage (120-277 Vac) input, 50/60 Hz. Power factor > 0.9, THD < 20%, in-rush current < 15 Amps.

FINISH - All reflective surfaces are finished with a high reflectance lighting fixture white polyester powder.

DRIVER – High-performance isolated driver features over-voltage, over-current and short circuit (with auto-recovery) protection. Driver module is sealed to IP66 protection levels, with a Class A sound rating. 0-10V dimming standard.

WARRANTY - Limited 5-year warranty.

PHOTOMETRICS - Please visit our web site at **www.lsi-industries.com** for detailed photometric data.

LISTING - Listed to UL1598 and UL 8750. Suitable for damp locations. IC rated. For a list of the specific products in this series that are DLC listed, please consult the LED Lighting section of our website or the Design Lights website at www.designlights.org.

This product, or selected versions of this product, meet the standards listed below. Please consult factory for your specific requirements.

ARRA Funding Compliant · c UL us LISTED damp location · RoHS COMPLIANT · DLC · USA

LIGHT OUTPUT - LED GA P12

		2 x 4			2 x 2			1 x 4		
		Lumens	Watts	LPW	Lumens	Watts	LPW	Lumens	Watts	LPW
Neutral White	SS	5160	45	114	3027	29	104	3215	29	111
	HO	6250	57	109	3490	35	100	3706	34	109
	VHO	9595	88	109	4825	44	109	5070	44	115

LED Chips are frequently updated therefore values may increase.

LUMINAIRE ORDERING INFORMATION

TYPICAL ORDER EXAMPLE: **GA24 LED SS NW UE P12 FC1**

Prefix	Light Source	Drive Current	Color Temperature	Input Voltage	Options
GA24 - (2x4) GA22 - (2x2) GA14 - (1x4)	LED	SS -Super Saver HO - High Output VHO - Very High Output	CW - Cool White (5000K) NW - Neutral White (4000K) WW - Warm White (3500K)	UE - Universal Input Voltage (120-277V) 347 - 347V	FC1 - 6' 3/8" flex, 3 #18 leads (other types available) JP - Job packed without cartons EM - Emergency Pack P12 - Pattern 12 Acrylic Nominal .095 Thickness P12 .125 - Pattern 12 Acrylic Nominal .125 Thickness SD50- Step Dimming to 50% RA - Regressed Aluminum Door Frame FA - Flat Aluminum Door Frame LDE5 - Lutron 5-Series LDE1 - Lutron Hi-lume 1% with Soft-On, Fade-to-Black L3D - Lutron Hi-lume 1%

ACCESSORY ORDERING INFORMATION (Accessories are field installed)

Description	Order Number
Flange Kit - 2x4	FK24
Flange Kit - 2x2	FK22
Flange Kit - 1x4	FK14

Lutron is a registered trademark of Lutron Electronics Co., Inc.

Project Name _____ Fixture Type _____

Catalog # _____

08/03/16

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LSI INDUSTRIES INC.

LEDBIAX® LINE VOLTAGE | BIAX STYLE LAMP



Easy line voltage (120-277V AC) LED replacement for BIAX™ style fluorescent lamps (4 pin-2G11). Simply remove fluorescent tube and ballast and install LEDBIAX®. Patented fully diffused lens cover for uniform, glare free illumination. Non Dimmable.

PROJECT NAME

PART NUMBER

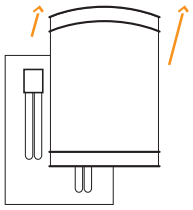
PART NUMBER BUILDER

MANUFACTURER	MODEL NUMBER	LUMENS	COLOR TEMPERATURE	BASE TYPE
RPT	LEDBIAX			2G11
		1500LM (16IN) 2000LM (22IN)	3000K 4000K	

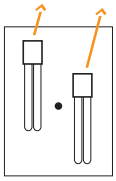
ORDERING EXAMPLE

RPT-LEDBIAX-1500LM-3000K-2G11

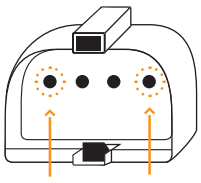
INSTALLATION GUIDE



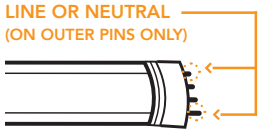
1 Disconnect power at panel & remove fixture lens.



2 Remove existing CFL 2G11 lamp.



3 Remove or bypass the existing ballast. Connect the AC line voltage to the 2G11 socket as shown above.



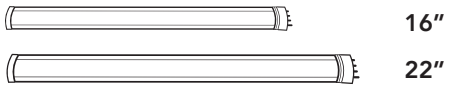
4 Install the LEDBIAX tube into the fixture, place provided warning labels near the appropriate lamp holder. Replace lens.

Simplified instructions. Reference full installation guide for more details. Only qualified personnel should perform installation.

QUICK SPECS

INPUT VOLTAGE	120-277V AC
EFFICACY	>100 lumens/watt
OPERATING TEMP	-30˚C to 45˚C
MAX CASE TEMP	50˚C
POWER FACTOR/THD	>0.90 Power Factor, THD<10%
CRI	83+
WARRANTY	5 years
CERTIFICATIONS	
PERFORMANCE LISTINGS	LM79/LM80 Available

DIMENSIONS





May be protected under the following US patents
US 8,106569 | US 8,882,298 | Additional patents pending.

LEDBIAX® LINE VOLTAGE | BIAX STYLE LAMP

ORDERING GUIDE

CASE QTY	ENERGY STAR	LDL	PART #	LUMEN OUTPUT (LM)	WATTAGE (W)	CCT (K)	VOLTAGE RANGE (V AC)	WARRANTY (YRS)	TRADITIONAL EQUIVALENT	WATTS SAVED (W)
48		●	RPT-LEDBIAX-1500LM-3000K	1500	15	3000	120-277	5	36W 2G11 FL	21
48		●	RPT-LEDBIAX-1500LM-4000K	1500	15	4000	120-277	5	36W 2G11 FL	21
48		●	RPT-LEDBIAX-2000LM-3000K	2000	20	3000	120-277	5	40W 2G11 FL	20
48		●	RPT-LEDBIAX-2000LM-4000K	2000	20	4000	120-277	5	40W 2G11 FL	20

● CURRENTLY NO DLC OR ENERGY STAR CATEGORY EXISTS FOR LED PLL/BIAX LAMPS, THEREFORE WE HAD THE LEDBIAX LISTED WITH LIGHTING DESIGN LAB (LDL) FOR UTILITY INCENTIVES.

CONSTRUCTION AND APPLICATION



The "BIAX to LED" LEDBIAX lamps by RemPhos Technologies offers an economical alternative to upgrade to long lasting LED lighting, while retaining the original fixture. The LED BIAX® series replaces fluorescent 16in. and 22in. lamps. Light is emitted 180 degrees so that the original fixture will be illuminated perfectly and uniformly. Extremely efficient at >100LPW, the LEDBIAX runs off of a built in driver operating at 120-277VAC through its 2G11 pin base. UL Listed. Multiple lumen output and CCTs are available.

STAINLESS STEEL CLIPS





Over time UV emissions from your old fluorescent lamp have degraded the original plastic clips supporting the lamp. Included with your LEDBIAX lamps are new stainless steel clips for a safe, strong install.

Printed on paper that is FSC® Certified, SFI® Certified Sourcing and Rainforest Alliance Certified™.
10% post consumer recycled content and certified fiber, it's the optimal environmental choice, because RemPhos cares.

RemPhos Technologies LLC • p 877.997.3674 • www.remphos.com
90 Holten Street • Danvers, MA USA • sales@remphos.com

A19 9W 277V TITANIUM LED SERIES

GREENCREATIVE

ENERGY STAR

PRO



9W REPLACES



60W Inc.

80% Energy Savings

$151 Savings per lamp*

- **Universal voltage 120-277V**
- **Exceptional efficacy 89 LPW in Soft White**
- **40% more energy savings than CFL**
- **Comfortable warm diffused light**
- **Natural A-lamp shape fits all applications**
- **Suitable for use in totally enclosed fixtures**

25,000 H

120-277V UNIVERSAL

89 LPW EFFICACY

3 YR WARRANTY

82 CRI (Ra)

ENCLOSED**

c UL us LISTED

FC

lighting facts LED Product Partner

LM 79 LM 80 TM 21 IES

A19 PRODUCT FEATURES

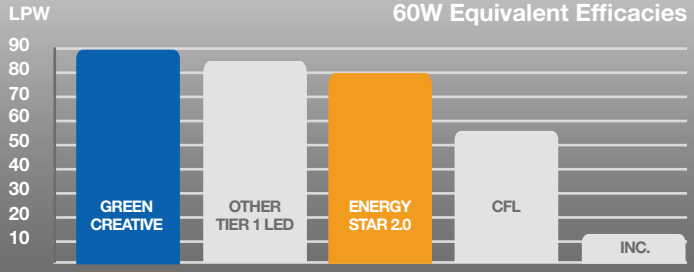
Suitable for Enclosed Fixtures

This A19 is suitable for use in totally enclosed fixtures and capable of operating in a broad range of applications. Whether it is installed in fully enclosed flushmounts or sconces, this lamp's advanced thermal design ensures optimal performance over the course of its lifetime.

ENCLOSED



Exceptional Efficacy



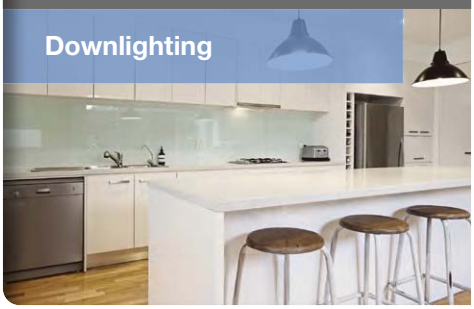
At 89 LPW, this lamp's efficacy is higher than the Tier 1 LED A19 60W replacement industry average and exceeds the new ENERGY STAR 2.0 requirements. This energy-saving performance makes this lamp a smart retrofit choice for incandescent and CFL bulbs.

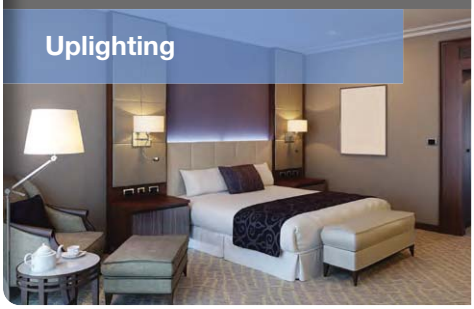
A19 9W 277V TITANIUM LED SERIES

GREENCREATIVE

APPLICATIONS







Ref.#DS032-A19-9W-277V-131217

SPECIFICATIONS

Product Model	58037 9A19/827/277V	58038 9A19/830/277V	58039 9A19/840/277V
Type	A19	A19	A19
Base	E26	E26	E26
Power (W)	9	9	9
Voltage - Frequency	120-277V 60Hz	120-277V 60Hz	120-277V 60Hz
Color Temp. (ANSI)	Soft White 2700K	Warm White 3000K	Cool White 4000K
CRI (Ra)	82	82	82
Typical lumens (lm)	800	820	860
Efficacy (LPW)	89	91	96
Beam Angle	240°	240°	240°
Dimmable	No	No	No
Power Factor	0.9	0.9	0.9
Rated Lifetime - L70 (hrs.)	25,000	25,000	25,000
Dia. x MOL	2.36”x4.41” (60x112mm)	2.36”x4.41” (60x112mm)	2.36”x4.41” (60x112mm)
Weight (lb. / g)	0.10lb. / 45g	0.10lb. / 45g	0.10lb. / 45g

* Savings per lamp based on $0.11 / kw energy cost, 12 hrs / day lamp usage, $2 incandescent with 1000-hr lifetime, $16 LED with 25,000-hr lifetime

** Suitable for use in totally enclosed fixtures

*** Suitable for damp locations. Not for use where directly exposed to weather or water

BR40 10.5W WARM DIM. TITANIUM LED SERIES

GREENCREATIVE

ENERGY STAR

WARM DIM



CLOUD DESIGN

PRO

10.5W REPLACES



65W Inc.

80% Energy Savings

$199 Savings per lamp*

- **Revolutionary CLOUD design**
- **55% lighter due to environmentally friendly construction**
- **Smooth warm dimming from 2700K-2200K CCT**
- **High efficacy 70 LPW**
- **Accurate color rendering CRI 82**
- **Comfortable warm diffused light**

25,000 H

2700K 2200K WARM DIM

70 LPW EFFICACY

3 YR WARRANTY

82 CRI (Ra)

ENCLOSED**

c UL us LISTED

FC

LM 79 LM 80 TM 21 IES

WARM DIMMING 2700K-2200K CCT



2700K 2200K

WARM DIM



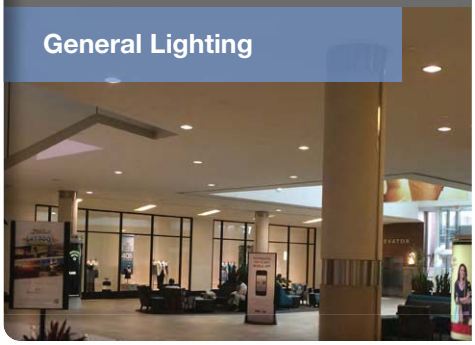
These GREEN CREATIVE lamps feature 2700K-2200K CCT dimming designed to replicate the warm dimming effect of traditional incandescent light sources. As the lamp dims, its CCT gradually warms, helping to create the perfect ambience for all occasions.

BR40 10.5W WARM DIM. TITANIUM LED SERIES

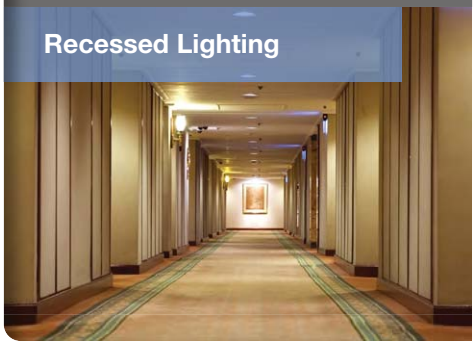
GREENCREATIVE

APPLICATIONS

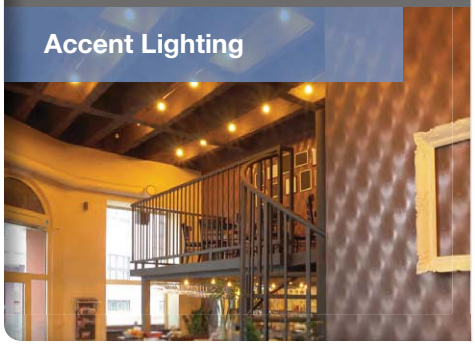
General Lighting



Recessed Lighting



Accent Lighting



Ref.#: DS167-BR40-10.5W-WARM-DIM-200417

SPECIFICATIONS

Product	**58002**
Model	**10.5BR40DIM/8CCTD**
Type	BR40
Base	E26
Power (W)	10.5
Voltage - Frequency	120V 60Hz
Color Temp. (ANSI)	Amber White-Soft White 2200K-2700K
CRI (Ra) (typ.)	82
Typical lumens (lm)	735
Efficacy (LPW)	70
Beam Angle	110°
Dimmable	Yes***
Power Factor	0.9
Rated Lifetime - L70 (hrs.)	25,000
Dia. x MOL	4.92''x6.10'' (125x155mm)
Weight (lb. / g)	0.38lb / 172g

* Savings per lamp based on $0.11 / kw energy cost, 12 hrs / day lamp usage, $2 incandescent with 1000-hr lifetime, $20 LED with 25,000-hr lifetime

** Suitable for use in totally enclosed fixtures
*** List of tested dimmer switches available on website
**** Suitable for damp locations. Not for use where directly exposed to weather or water

PAR30SN 11W DIM. TITANIUM CRI^{SP} LED SERIES 4.0

GREENCREATIVE

ENERGY STAR

HIGH CRI
LED TECHNOLOGY

REFINE SERIES

CRI^{SP}





11W REPLACES



75W Hal.

80% Energy Savings

$241 Savings per lamp*

- **Full-face optic and sleek design**
- **Exceptional color rendering CRI 90**
- **Richer reds and natural skin tones (R9 50, R13 90)**
- **Tight LED binning for consistent CCT across all lamps**
- **High efficacy 67 LPW in Warm White**
- **Suitable for use in totally enclosed fixtures**

40,000 H

DIMMABLE

67 LPW EFFICACY

5 YR WARRANTY

90 CRI (Ra)

ENCLOSED**

c UL us LISTED

FC

lighting facts LED Product Partner

LM 79 LM 80 TM 21 IES

PATENT PENDING REFINE OPTIC

The innovative REFINE optic provides a high candela to lumen ratio, optimizing light usage for directional applications.

REFINE SERIES

WATCH THE VIDEO

REFLECTOR
Directs light



FOCUS LENS
Focuses center beam



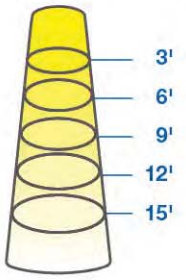
SHAPING LENS
Refines beam pattern

PAR30SN 11W DIM. TITANIUM CRI^{SP} LED SERIES 4.0

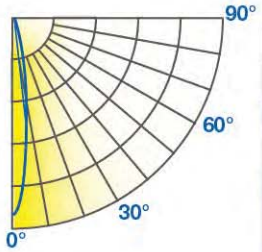
GREENCREATIVE

ILLUMINANCE & CANDELA DISTRIBUTION

14PAR30SNG4DIM/930SP15

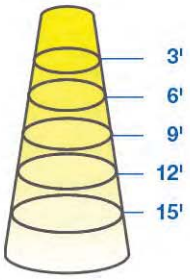


Diameter	Footcandles
0.8	689
1.6	172
2.4	77
3.2	43
3.9	28

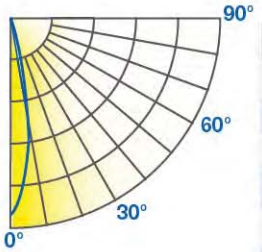


Degree	Candela
0	6200
5	3790
15	928
25	197
35	81
45	46

11PAR30SNG4DIM/930NF25

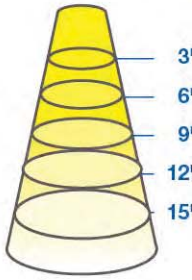


Diameter	Footcandles
1.3	323
2.7	81
4.0	36
5.3	20
6.7	13

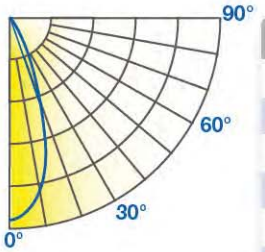


Degree	Candela
0	2910
5	2506
15	994
25	209
35	59
45	35

11PAR30SNG4DIM/930FL40



Diameter	Footcandles
2.2	161
4.4	40
6.6	18
8.7	10
10.9	6



Degree	Candela
0	1450
5	1406
15	988
25	346
35	95
45	45

For other CCT use the following multipliers: 2700K .95, 4000K 1.08

Base:	E26
Voltage:	120V
Dimmable:	Yes***
PF:	0.9
Lifetime:	40,000 hrs
Weight:	0.38lb / 172g



SPECIFICATIONS

Model	Product	Power (W)	CCT	CRI (typ.)	R9 / R13 (typ.)	Lumens	LPW	Beam Angle	CBCP (cd)
14PAR30SNG4DIM/927SP15	16129	14	Warm White 2700K	90	50 / 90	700	50	SP 15°	6155
11PAR30SNG4DIM/927NF25	16130	11	Warm White 2700K	90	50 / 90	705	64	NF 25°	2910
11PAR30SNG4DIM/927FL40	16131	11	Warm White 2700K	90	50 / 90	705	64	FL 40°	1400
14PAR30SNG4DIM/930SP15	16132	14	Warm White 3000K	90	50 / 90	725	52	SP 15°	6200
11PAR30SNG4DIM/930NF25	16133	11	Warm White 3000K	90	50 / 90	740	67	NF 25°	2910
11PAR30SNG4DIM/930FL40	16134	11	Warm White 3000K	90	50 / 90	740	67	FL 40°	1450
11PAR30SNG4DIM/940FL40	16137	11	Natural White 4000K	90	50 / 90	780	71	FL 40°	1500
14PAR30SNG4DIM/930SP15/B •	16232	14	Warm White 3000K	90	50 / 90	725	52	SP 15°	6200
11PAR30SNG4DIM/930NF25/B •	16233	11	Warm White 3000K	90	50 / 90	740	67	NF 25°	2910
11PAR30SNG4DIM/930FL40/B •	16234	11	Warm White 3000K	90	50 / 90	740	67	FL 40°	1450

• Black finish

* Savings per lamp based on $0.11 / kw energy cost, 12 hrs / day lamp usage, $8 halogen with 1500-hr lifetime, $28 LED with 40,000-hr lifetime
** Suitable for use in totally enclosed fixtures
*** List of tested dimmer switches available on website
**** Suitable for damp locations. Not for use where directly exposed to weather or water

Ref.#:DS059-PAR30SN-11W

PROJECT INFORMATION

Project Name	Type
Catalog #	Date

RETROFIT TROFFER KIT

2-LAMP PRISMATIC



APPLICATIONS
- Retrofit Troffer Kit

APPROVALS
- Complies with UL 1598 and CSA 22.2
- Suitable for damp locations.

AT A GLANCE

NUMBER OF LAMPS	LAMP TYPE
2/3/4	T5/T8 Fluorescent

FEATURES
- Increase efficiency by upgrading the existing 2 lamp prismatic troffers with a reflector.
- Available in 2ft. and 4ft. lengths.
- No need for top feed power relocation.
- Available in enhanced aluminum or white.
- Custom kits available.
- Uniform illumination.
- Two designs to choose from depending on existing fixture dimensions.

CONSTRUCTION
- One piece reflectors are manufactured from .016 thick aluminum.
- Lamp relocation brackets are die formed code gauge steel.
- Reflectors are secured to brackets with pinch tabs for ballast access.
- Kit comes complete with reflector, Tek screws, lampholder brackets and low profile lampholders.

WARRANTY
- 1 year limited warranty.

ORDER LOGIC

SAMPLE CATALOG NUMBER: RTK202T5MARS

RTK						

LENGTH	NO. LAMPS	LAMP TYPE	REFL. MATERIAL	OPTICS	LAMP HOLDERS
2 2 ft.	**02**	T8	**M** Enhanced Aluminum (95%)	**A** Profile "A"	**RS** Unshunted Lampholders
4 4 ft.	**03**	T5	**W** White Aluminum (91%)	**E** Profile "E"	**SH** Shunted Lampholders
	04				

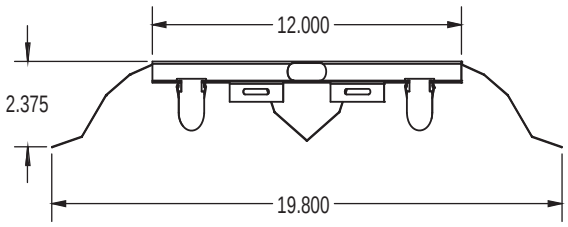
www.xtralight.com • **(800) 678-6960** • customerservice@xtralight.com
All information is believed to be accurate at the time of publication. **Please contact customer service or visit www.xtralight.com for the most updated product specifications.** XtraLight® reserves the right to change specifications without notice.

RETROFIT TROFFER KIT

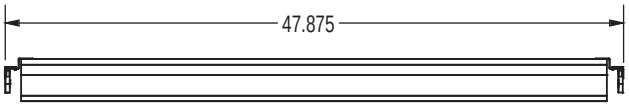
2-LAMP PARABOLIC

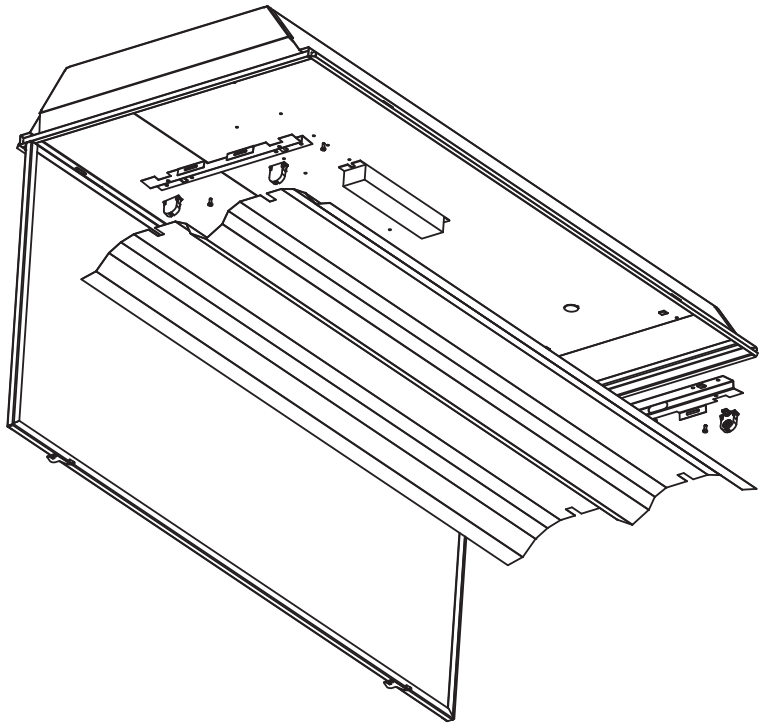
DIMENSIONAL DATA

End View



Side View





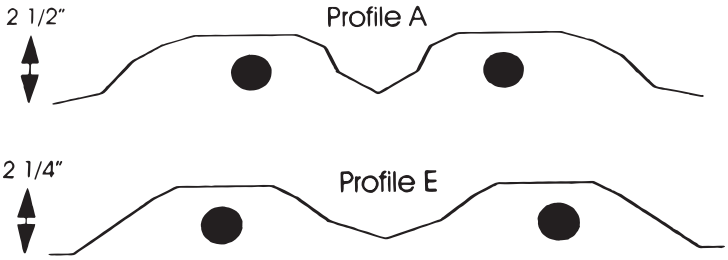
KIT INCLUDES

REFLECTOR

RACEWAYS

LAMPHOLDERS

TEK SCREWS



All information is believed to be accurate at the time of publication. **Please contact customer service or visit www.xtralight.com for the most updated product specifications.** XtraLight® reserves the right to change specifications without notice.

2050 LED

PROJECT:
MODEL #:
FIXTURE TYPE:

STANDARD SPECIFICATIONS

PAN
Cold rolled 22 GA steel, formed in a die, with nut inserts for attaching the diffuser. Available in multiple sizes.

DIFFUSER
Translucent, UV stabilized, white acrylic. Diffuser is molded to provide uniform thickness throughout. Available in an optional white polycarbonate version.

LED PERFORMANCE - 3500K STANDARD
120-277V - 3500K, 82 CRI - L80 rating - 60,000 hrs - L70 rating (projected) - 100,000 hrs
Amperage rated @ 110V input
Operating ambient temperature: -20°C / -4°F - 40°C / 104°F

Standard 3500K source lumens noted. Consult Brownlee.com for performance of all CCTs.
B6LED - 6W nominal, .05 A input - 698 lm - 114 lm/W
B12LED - 12W nominal, .10 A input - 1422 lm - 120 lm/W
C9LED - 9W nominal, .10 A input - 1072 lm - 122 lm/W
C17LED - 17W nominal, .15 A input - 1829 lm - 111 lm/W
C24LED - 24W nominal, .20 A input - 2558 lm - 107 lm/W
C37LED - 37W nominal, .30 A input - 3837 lm - 104 lm/W
C49LED - 49W nominal, .40 A input - 5116 lm - 107 lm/W

MOUNTING
Directly to j-box (by others). Mounting hardware included.

FINISH
The 2050 series is standard in a high reflectance white powder coat finish or an optional black finish.

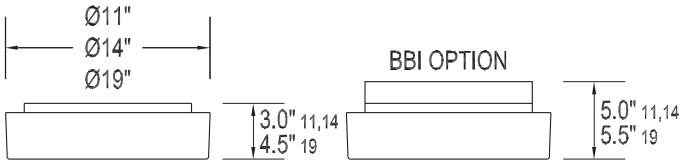
WARRANTY
5 year limited warranty on this LED product. Consult factory for details.



BL finish



WH finish



DAMP

ADA

SUPPORTS T24 COMPLIANCE

Ceiling / Wall

ORDERING INFORMATION

2050 - _____ - _____ - _____ - _____ - _____ - _____

Model | 2. | 3. | 4. | 5. | 6. (if required)

2. SIZE

11	11" dia.
14	14" dia.
19	19" dia.

3. FINISH

STANDARD

WH	White

OPTIONAL

BL	Black

4. WATTAGE

11 SIZE

B6LED	1-B Series board
B12LED	2-B Series boards
C9LED	1-C Series board

14 SIZE

B6LED	1-B Series board
B12LED	2-B Series boards
C9LED	1-C Series board
C17LED	2-C Series boards
C24LED	2-C Series boards

19 SIZE

B12LED	2-B Series boards
C17LED	2-C Series boards
C24LED	2-C Series boards
C37LED	3-C Series boards
C49LED	4-C Series boards

5. DIFFUSER

STANDARD

WA	White Acrylic

OPTIONAL

WP	White Polycarbonate

6. AVAILABLE OPTIONS

35K	3500K standard color temperature
27K	2700K color temperature
30K	3000K color temperature
40K	4000K color temperature
90R	90 CRI (3000K only)
BAC	Buy American Compliant
BBI[4,5,6]	Integral Battery Backup (Adds 2" to depth) 14 size - All wattages 19 size - B12LED & C24LED only
BLD[2,3,5]	Bi-Level Dimming (All except B6LED, 14 & 19 size only)
DALI	Dali Compatible (0-10v dimming included) (C17LED, C24LED & C49LED only)
DIM	Dimming driver (120-277V) (All except B6LED)(0-10V dimming control required)
DTR	Triac (Line Voltage) Dimming (120V) (All except B6LED, C17LED, & C37LED)
ES	ENERGY STAR® (Not available in 90 CRI)
OCC[2]	Occupancy Sensor (14 & 19 size only)
T24[9]	Title 24 Compliant (B12LED, C24LED & C49LED in 3000K only)

2) Occupancy sensor operates with microwaves and is not recommended for use in waiting areas with elevators
3) Bi-Level dimming includes a 0-10V dimming driver and is field adjustable from 100% to a dimmed level of 10,20,30 or 50%. All units are factory set at 50%
4) Cannot be combined with BLD, DALI or OCC options
5) Cannot be combined with DALI
6) BBI option has a minimum operating temperature of 50°F
9) Title 24 Compliance includes 0-10v dimming, 90 CRI and 2016 JA8 High Efficacy compliant fixture labeling. Contact factory for LED performance specifications.

Specifications and dimensions subject to change without notice.
Consult your Brownlee Lighting representative for availability and ordering information.

BROWNLEE LIGHTING
www.brownlee.com

REVISED
2018.7.12

Specification Sheet: Line-Voltage LED Battery Backup Kit

The LED Battery-Backup Solution

When your power goes out, Revolution Lighting's Line-Voltage LED Battery Backup Kit is the ideal accessory to have. This backup system is designed with single-end-power LED tube lights in mind but can power any 120VAC line-voltage LED lighting system up to 25W at full power for 90 minutes or more during an outage. * And when the power is on, the battery draws no more than 6W max from any 120-277VAC supply circuit while charging.

The NiCad battery is surface-mounted, has an expected lifetime of 7-10 years, and includes mounting hardware, wire nuts, and a testing switch.

** Caution: Do not power any lighting system over 25W or the battery could overheat and be damaged. Not for use with higher-wattage LED high bays, wall packs, etc.*

GENERAL SPECIFICATIONS

- 120-277VAC input charging voltage
- 170VDC output voltage (compatible with 120VAC LED driver inputs)
- Up to 25W power output
- More than 90 minutes of backup time at rated wattages
- 6W power draw when charging

PRODUCT BENEFITS

- Universal input voltage (120-277VAC)
- Perfect battery backup for line-voltage LEDs, providing full power up to 25W for 90 minutes or more
- Expected battery lifetime of 7-10 years
- Works with any Revolution Lighting product requiring 120VAC line voltage (25W max)
- Long-life NiCad battery in surface-mounted housing with flexible metal conduit

WARRANTY



Our Industry-Leading 7-Year Limited Warranty Guarantees Unsurpassed Quality

TECHNICAL DATA (Subject to change.)

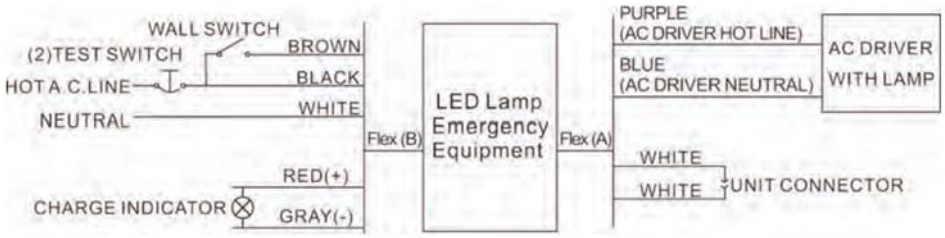
Product SKU No.	Input Voltage (VAC)	Output Wattage (W)	Output Voltage (VDC)	Battery Backup Time	Recharge Time (hr)	Charging Wattage (W)	Mounting	Included Hardware	Rated Life (Years)	Operating Temp. (°F)
150000-P05	120-277	25W (Max) *	170 (120VAC Compatible)	≥ 90 min	48	≤ 6	Surface	Test Switch, Mounting Hardware, Wire Nuts	7-10	32 to 122

** Caution: Do not power any lighting system over 25W or the battery could overheat and be damaged.*

Note: Battery-Backup Kit is not rated for insulation contact (IC). Avoid direct contact with insulation.



WIRING DIAGRAM



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Specifications subject to change without notice.

For more information, visit **rvlti.com** or call **877-578-2536.**

Specification Sheet: Uni-Fit T8 LED Tubes

Retrofitting Is Easy with Our Energy Efficient LED Tubes

Our lightweight, shatterproof, all-plastic T8 Uni-Fit LED tubes can reduce your lighting energy use by as much as 55% compared to fluorescent lights and provide a superior quality of light.

Our tubes are ballast-ready for easy installation without rewiring and are backed with our industry-leading 70,000-hour rated lamp life and 10-year warranty.

See Order Logic table below for our BAA compliant products. Contact your Revolution Lighting representative for pricing or more information.

APPLICATIONS

- Offices & Commercial Buildings
- Retail Settings
- Hotels
- Schools
- Hospitals
- Warehouses
- Assisted Living Facilities
- Food Processing Centers
- Parking Garages
- Recreation Centers

ILLUMINATION ANGLE



Revolution Lighting Light Distribution

CAN DECREASE ENERGY USAGE BY



vs. Similar Fluorescent Lamps

WARRANTY



Our Industry-Leading 10-Year Limited Warranty Guarantees Unsurpassed Quality

PRODUCT BENEFITS

OPERATIONAL

- 3X greater lamp life than fluorescent, supported by industry-leading 10-year warranty
- 70,000 hour lamp life reduces long-term maintenance costs
- Instant on, no warm-up time

SAFETY

- No glass
- Negligible light depreciation over time
- Superior light output
- These UL Type A tube lamps are tested to comply with UL 1993

SUSTAINABILITY

- Lack of UV or IR minimizes concerns with fading or discoloration
- Mercury-free, allowing for non-hazardous disposal
- 100% recyclable



ORDER LOGIC (Ex. UF-36-9-F-35-USA or UF-36-9-F-35)

Product Description		Length (in.)		Bare Lamp Wattage		Lens		CCT (K Temp)		BAA
UF = Uni-Fit (Ballast-Ready)	–	24 = 2ft	–	7.5 = 7.5W	–	F = Frosted	–	30 = 3000K 35 = 3500K 40 = 4000K 50 = 5000K	–	Blank = Standard (non-BAA) USA = BAA (Buy American Act) A = TAA (Trade Agreements Act)
UF = Uni-Fit (Ballast-Ready)	–	36 = 3ft		9 = 9W						
UF = Uni-Fit (Ballast-Ready)	–	48 = 4ft		12 = 12W 14 = 14W 17 = 17W						
UF = Uni-Fit (Ballast-Ready)	–	U = U-Bent	–	18 = 18W			–	30 = 3000K 35 = 3500K 40 = 4000K 50 = 5000K	–	(Not available with BAA at this time.)

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Specifications subject to change without notice.

For more information, visit **rvlti.com** or call **877-578-2536.**

Specification Sheet: Uni-Fit T8 LED Tubes

TECHNICAL DATA (Subject to change)

Catalog No.	Product SKU No.	BAA/TAA Option*	Rated System Wattage	Lens	Base	Input Voltage	Color Temp (K)	Rated Lumens	Rated Efficacy	CRI	Illumination Angle	Rated Life (Hours)	Operating Temp. (°F)	NSF Listed
2-foot 7.5W Uni-Fit Tube														
UF-24-7.5-F-35	202220-012	Yes	9	Frosted	G13	Ballast	3500	1,500	167	80	320	70,000	-4 to 122	
UF-24-7.5-F-40	202220-013	Yes	9	Frosted	G13	Ballast	4000	1,500	167	80	320	70,000	-4 to 122	
UF-24-7.5-F-50	202220-015	Yes	9	Frosted	G13	Ballast	5000	1,500	167	80	320	70,000	-4 to 122	
3-foot 9W Uni-Fit Tube														
UF-36-9-F-35	203220-012	Yes	14.3	Frosted	G13	Ballast	3500	1,621	114	84	320	70,000	-4 to 122	
UF-36-9-F-40	203220-013	Yes	14.3	Frosted	G13	Ballast	4000	1,615	113	82	320	70,000	-4 to 122	
UF-36-9-F-50	203220-015	Yes	14.3	Frosted	G13	Ballast	5000	1,672	117	83	320	70,000	-4 to 122	
4-foot G2 12W Uni-Fit Tube														
UF-48-12-F-30	204220-011	Yes	15.6	Frosted	G13	Ballast	3000	1,745	111	83	320	70,000	-4 to 122	•
UF-48-12-F-35	204220-012	Yes	13.9	Frosted	G13	Ballast	3500	1,759	127	83	320	70,000	-4 to 122	
UF-48-12-F-40	204220-013	Yes	13.9	Frosted	G13	Ballast	4000	1,646	119	85	320	70,000	-4 to 122	•
UF-48-12-F-50	204220-015	Yes	13.9	Frosted	G13	Ballast	5000	1,687	122	85	320	70,000	-4 to 122	•
4-foot G2 14W Uni-Fit Tube														
UF-48-14-F-35	204221-012	Yes	15.6	Frosted	G13	Ballast	3500	1,735	111	82	310	70,000	-4 to 122	
UF-48-14-F-40	204221-013	Yes	15.6	Frosted	G13	Ballast	4000	1,971	126	83	310	70,000	-4 to 122	•
UF-48-14-F-50	204221-015	Yes	15.3	Frosted	G13	Ballast	5000	1,792	117	86	310	70,000	-4 to 122	•
4-foot G2 17W Uni-Fit Tube														
UF-48-17-F-35	204222-012	Yes	17.8	Frosted	G13	Ballast	3500	1,926	108	82	310	70,000	-4 to 122	
UF-48-17-F-40	204222-013	Yes	17.6	Frosted	G13	Ballast	4000	2,110	120	86	310	70,000	-4 to 122	•
U-Bent 18W Uni-Fit Tube														
UF-U-18-F-30	207221-211	No	18.4	Frosted	G13	Ballast	3000	2,227	121	81	276	50,000	-4 to 113	•
UF-U-18-F-35	207221-212	No	18.4	Frosted	G13	Ballast	3500	2,247	122	81	276	50,000	-4 to 113	•
UF-U-18-F-40	207221-213	No	18.4	Frosted	G13	Ballast	4000	2,267	123	81	276	50,000	-4 to 113	•
UF-U-18-F-50	207221-215	No	18.5	Frosted	G13	Ballast	5000	2,306	124	85	276	50,000	-4 to 113	•

Product is DLC listed.

**Note: When ordering BAA- or TAA-compliant tubes, include the extension "-USA" or "-A" after the SKU No., respectively, as shown in the Order Logic table.*

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Specifications subject to change without notice.

Specification Sheet: Uni-Fit T8 LED Tubes

PHYSICAL DATA

Catalog No.	Product SKU No.	Product Dimensions (in.)	Product Weight (lb)
2-foot 9W Uni-Fit Tube			
UF-24-7.5-F-35	202220-012	24L x 1 Dia.	0.22
UF-24-7.5-F-40	202220-013	24L x 1 Dia.	0.22
UF-24-7.5-F-50	202220-015	24L x 1 Dia.	0.22
3-foot 9W Uni-Fit Tube			
UF-36-9-F-35	203220-012	36L x 1 Dia.	0.30
UF-36-9-F-40	203220-013	36L x 1 Dia.	0.30
UF-36-9-F-50	203220-015	36L x 1 Dia.	0.30
4-foot G2 12W Uni-Fit Tube			
UF-48-12-F-30	204220-011	48L x 1 Dia.	0.38
UF-48-12-F-35	204220-012	48L x 1 Dia.	0.38
UF-48-12-F-40	204220-013	48L x 1 Dia.	0.38
UF-48-12-F-50	204220-015	48L x 1 Dia.	0.38
4-foot G2 14W Uni-Fit Tube			
UF-48-14-F-35	204221-012	48L x 1 Dia.	0.54
UF-48-14-F-40	204221-013	48L x 1 Dia.	0.54
UF-48-14-F-50	204221-015	48L x 1 Dia.	0.54
4-foot G2 17W Uni-Fit Tube			
UF-48-17-F-35	204222-012	48L x 1 Dia.	0.54
UF-48-17-F-40	204222-013	48L x 1 Dia.	0.54
U-Bent 18W Uni-Fit Tube			
UF-U-18-F-30	207221-211	22.50L x 7.13W x 1.00H	0.52
UF-U-18-F-35	207221-212	22.50L x 7.13W x 1.00H	0.52
UF-U-18-F-40	207221-213	22.50L x 7.13W x 1.00H	0.52
UF-U-18-F-50	207221-215	22.50L x 7.13W x 1.00H	0.52

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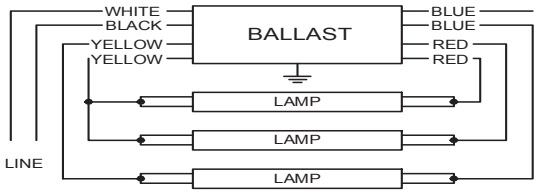
ADVANCE TRANSFORMER CO.

Electrical Specifications

IOP-4P32-N @ 277V	
Brand Name	**OPTANIUM**
Ballast Type	**Electronic**
Starting Method	**Instant Start**
Lamp Connection	**Parallel**
Input Voltage	**120-277**
Input Frequency	**50/60 HZ**
Status	**Active**

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* F32T8	4	32	-20/-29	0.40	108	0.88	10	0.99	1.2	0.81
F32T8/ES (25W)	4	25	60/16	0.32	86	0.87	10	0.98	1.6	1.01
F32T8/ES (28W)	4	28	60/16	0.35	96	0.88	10	0.99	1.6	0.92

Wiring Diagram



	in.	cm.

Diag. 71

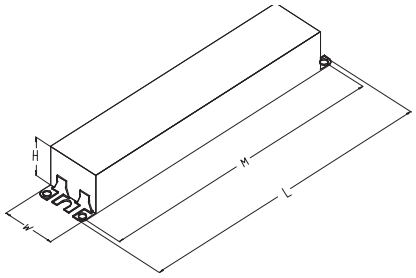
Insulate unused blue lead for 1000V

The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.5 "	1.3 "	1.0 "	8.9 "
9 1/2	1 3/10	1	8 9/10
24.1 cm	3.3 cm	2.5 cm	22.6 cm

RoHS COMPLIANT

Revised 05/21/12

Data is based upon tests performed by Advance Transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

ADVANCE TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 847-768-7768
Corporate Offices: Phone: 800-322-2086

IOP-4P32-N @ 277V	
Brand Name	**OPTANIUM**
Ballast Type	**Electronic**
Starting Method	**Instant Start**
Lamp Connection	**Parallel**
Input Voltage	**120-277**
Input Frequency	**50/60 HZ**
Status	**Active**

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance

2.1 Ballast shall be _____ (Instant or Programmed) Start.

2.2 Ballast shall provide Independent Lamp Operation (ILO) for Instant Start or Programmed Start Parallel ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail.

2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.4 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V) with sustained variations of +/- 10% (voltage and frequency).

2.5 Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz and 52 kHz to avoid interference with infrared devices, eliminate visible flicker and avoid Article Surveillance System, such as anti-theft devices.

2.6 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.7 Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.77 for Low Watt, 0.87 for Normal Light Output, and 1.18 for High Light for Instant Start ballasts or 0.71 for Low Watt and 0.88 for Normal Light Output for Programmed Start ballasts.

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less.

2.9 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

2.10 Ballast shall have a Class A sound rating for all 4-foot lamps and smaller.

2.11 Ballast shall have a minimum starting temperature of -29C (-20F) on Instant Start ballasts or -18C (0F) on Programmed Start ballasts for standard T8 lamps and 16C (60F) for energy-saving T8 lamps. Consult lamp manufacturer for temperature versus light output characteristics.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions.

2.13 Ballast shall have lamp striation-reduction circuitry.

2.14 Programmed Start ballast shall provide lamp EOL protection circuitry.

2.15 Maximum distance for Energy Saving Lamps in Remote/Tandem wiring applications shall be 6 feet for Instant Start and Programmed Start models.

Section III - Regulatory

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, for Non-Consumer equipment.

3.6 Ballast shall meet NEMA Premium/CEE High Performance T8 Lighting System Specifications.

3.7 IOP or GOP ballast shall comply with UL Type CC rating.

3.8 Ballast shall comply with NEMA 410 for in-rush current limits.

3.9 Ballast shall meet RoHS Compliance Standards

Section IV - Other

4.1 Ballast shall be manufactured in an ISO 9001 Qualified factory.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at maximum case temperature of 90C.

4.3 Manufacturer shall have a twenty-year history of producing electronic ballasts for the North American market.

4.4 Energy-saving T8 lamps (25W, 28W or 30W) may experience lamp striations if operated on ballasts not rated for their use.

Revised 05/21/12

Data is based upon tests performed by Advance Transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

ADVANCE TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD - ROSEMONT, ILLINOIS 60018
TELEPHONE: (847)390-5000 FAX: (847)768-7768

Catalog # :	Project :
Prepared By :	Date :

MCOWP27W
27 Watt LED Cut-Off Wall Pack



LSI Wall Lights feature traditional housings that provide familiar design with known applications. These fixtures make the switch from Metal Halide to LED easy Mid-power LEDs provide glare-free white light.

Features & Specifications

Performance

4500K		
Delivered Lumens	**Efficacy**	**Wattage**
3,411	128.8	26.47

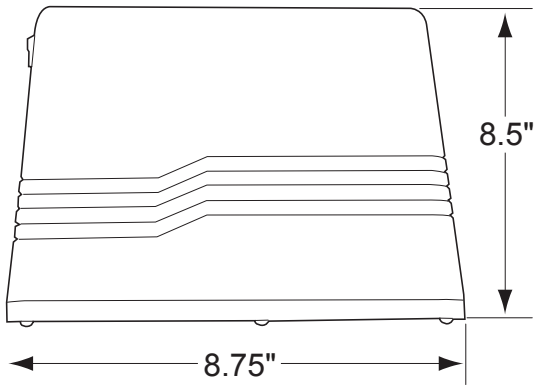
Optical System
- Lens assembly is designed to provide high efficiency and to target the light where needed to satisfy outdoor lighting requirements.
- Positioning of the LEDs result in the light being directed to desired locations eliminating glare and offensive light.
- 4500K color temperature.
- Minimum CRI of 82

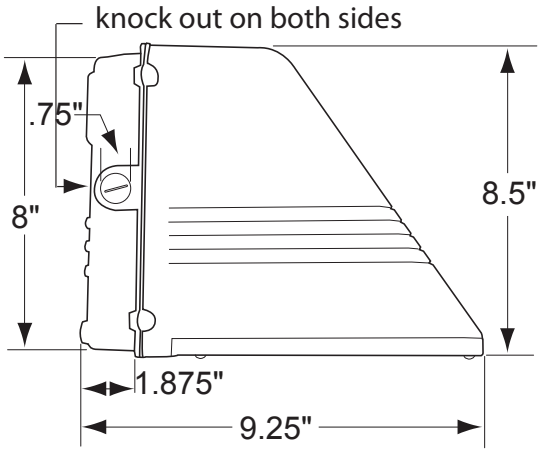
Electrical
- High-performance driver features over-voltage, under voltage, short-circuit and over temperature protection.
- 0-10 volt dimming (10% - 100%) standard.
- Standard Universal Voltage (120-277 Vac) Input 50/60 Hz
- L70 Calculated Life: >100k Hours
- Total harmonic distortion: <20%
- Power factor: >.85
- Input power stays constant over life.
- Driver Off-State Power is 0 watts.
- Components are fully encased in potting material for moisture resistance. Driver complies with FCC standards. Driver and key electronic components can easily be accessed.
- Minimum 2.5kV surge rating

Construction
- Rugged traditional aluminum die cast housing provides proven environmental protection for LED modules.
- Traditional fixture designs provide a familiar look and standard installation requirements.
- Retaining this look allows the ability to upgrade fixtures gradually, while retaining the same overall fixture appearance throughout a facility.
- The smooth housing prevents debris build up and maximizes airflow over housing.

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Dimensions





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MCOWP27W
27 Watt LED Cut-Off Wall Pack

Features & Specifications (Cont.)

- Patent pending thermal stacking technology system features a unique internal design that allows for lower operating temperatures which results in a brighter, whiter light, more stable color and longer LED and driver life.
- LSI LEDs provide higher lumen output, greater energy efficiency and more reliable fixture performance.
- LEDs manufactured for the MCOWP series utilize Epoxy Guard conformal coating which reduces the chance of board corrosion.

Controls
- Optional electronic button Photocontrol.
- Apertures for field or factory installed photocontrol.

Installation
- Fixture retains the same knock-out sizes and positions as previous models, reducing wiring costs.

Warranty
- LSI LED Fixtures carry a 5-year warranty.
- 1 Year warranty on optional Button Photocell.

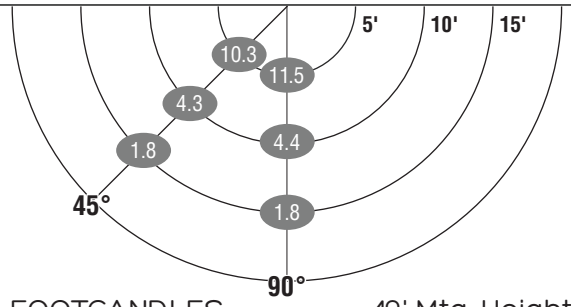
Listings
- Listed to UL 1598 and UL 8750.
- CSA Listed
- RoHS Compliant.
- DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.
- American Recovery and Reinvestment Act Funding Compliant.
- Lighting Facts Approved.
- Suitable For Wet Locations.

Finishes
- Bronze is standard. Consult factory for pricing and lead time for other options.

Energy Savings

LED		HID			
Wattage	Annual Cost	Source Wattage	Total Wattage Used	Annual Cost	Annual Savings
27	$12	50	72	$52	$40
		70	90	$59	$47
		100	129	$77	$65

Photometrics



FOOTCANDLES 10' Mtg. Height

Footcandles on the Ground							
Mounting Height	90°			45°			Avg FCs 450 sq. feet
	5'	10'	15'	5'	10'	15'	
10'	11.5	4.4	1.8	10.3	4.3	1.8	**5.7**
12'	9.0	4.4	2.1	8.3	4.3	2.1	**5.0**



Luminaire Ordering Guide

TYPICAL ORDER EXAMPLE: **MCOWP 27W 45K BZ PC120**

Family Prefix	Wattage	Color Temp	Finishes	Options / Controls
MCOWP	27W	45K - 4500K	BZ - Bronze	PC120 - 120V Button Photocontrol PC208-277 - 208-277V Photocontrol

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Catalog # :	Project :
Prepared By :	Date :

MCOWP64W
64 Watt LED Medium Cut-Off Wall Pack



LSI Wall Lights feature traditional housings that provide familiar design with known applications. These fixtures make the switch from Metal Halide to LED easy Mid-power LEDs provide glare-free white light.

Features & Specifications

Performance

4500K		
Delivered Lumens	**Efficacy**	**Wattage**
8,131	131.5	61.82

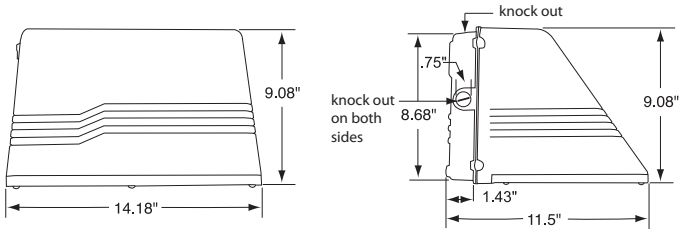
Optical System
- Lens assembly is designed to provide high efficiency and to target the light where needed to satisfy outdoor lighting requirements.
- Positioning of the LEDs result in the light being directed to desired locations eliminating glare and offensive light.
- 4500K color temperature.
- Minimum CRI of 82

Electrical
- High-performance driver features over-voltage, under voltage, short-circuit and over temperature protection.
- 0-10 volt dimming (10% - 100%) standard.
- Standard Universal Voltage (120-277 Vac) Input 50/60 Hz
- L70 Calculated Life: >100k Hours
- Total harmonic distortion: <20%
- Power factor: >.85
- Input power stays constant over life.
- Driver Off-State Power is 0 watts.
- Components are fully encased in potting material for moisture resistance. Driver complies with FCC standards. Driver and key electronic components can easily be accessed.
- Minimum 4kV surge rating

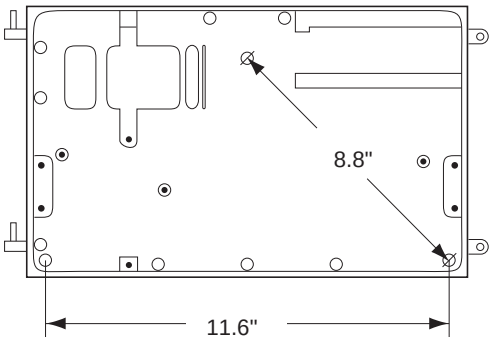
Construction
- Rugged traditional aluminum die cast housing provides proven environmental protection for LED modules.
- Traditional fixture designs provide a familiar look and standard installation requirements.
- Retaining this look allows the ability to upgrade fixtures gradually, while retaining the same overall fixture appearance throughout a facility.
- The smooth housing prevents debris build up and maximizes airflow over housing.

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Dimensions



Mounting Detail



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MCOWP64W
64 Watt LED Medium Cut-Off Wall Pack

Features & Specifications (Cont.)

- Patent pending thermal stacking technology system features a unique internal design that allows for lower operating temperatures which results in a brighter, whiter light, more stable color and longer LED and driver life.
- LSI LEDs provide higher lumen output, greater energy efficiency and more reliable fixture performance.
- LEDs manufactured for the MCOWP series utilize Epoxy Guard conformal coating which reduces the chance of board corrosion.

Controls
- Optional electronic button Photocontrol.
- Apertures for field or factory installed photocontrol.

Installation
- Fixture retains the same knock-out sizes and positions as previous models, reducing wiring costs.

Warranty
- LSI LED Fixtures carry a 5-year warranty.
- 1 Year warranty on optional Button Photocell.

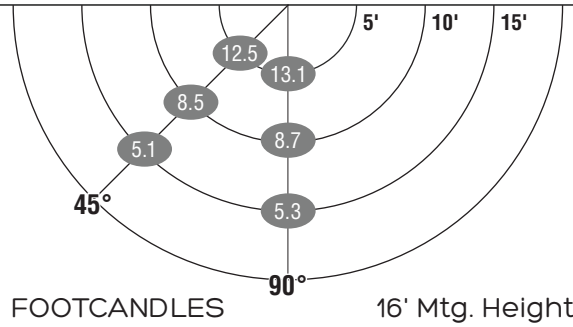
Listings
- Listed to UL 1598 and UL 8750.
- CSA Listed
- RoHS Compliant.
- DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.
- American Recovery and Reinvestment Act Funding Compliant.
- Lighting Facts Approved.
- Suitable For Wet Locations.

Finishes
- Bronze is standard. Consult factory for pricing and lead time for other options.

Energy Savings

LED		HID			
Wattage	Annual Cost	Source Wattage	Total Wattage Used	Annual Cost	Annual Savings
64	$28	200	232	$128	$100
		250	285	$150	$122
		400	458	$226	$198

Photometrics



FOOTCANDLES 16' Mtg. Height

Footcandles on the Ground							
Mounting Height	90°			45°			Avg FCs 450 sq. feet
	5'	10'	15'	5'	10'	15'	
16'	13.1	8.7	5.3	12.5	8.5	5.1	**8.9**
12'	10.6	7.7	5.1	10.2	7.5	4.9	**7.6**



Luminaire Ordering Guide

TYPICAL ORDER EXAMPLE: **MCOWP 64W 45K BZ PC120**

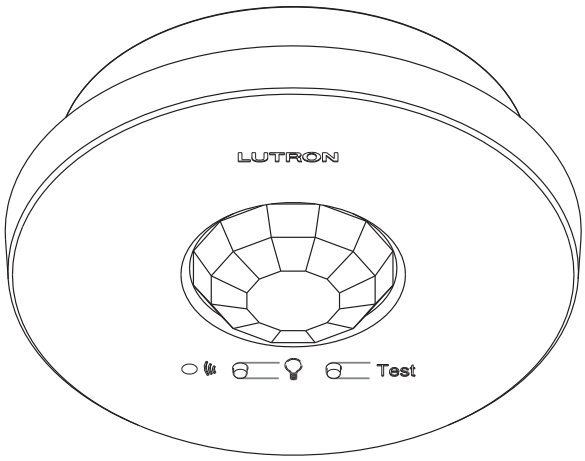
Family Prefix	Wattage	Color Temp	Finishes	Options / Controls
MCOWP	64W	45K - 4500K	BZ - Bronze	PC120 - 120V Button Photocontrol PC208-277 - 208-277V Photocontrol

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Radio Powr Savr™ Wireless Occupancy/Vacancy Ceiling Sensor

Lutron® Radio Powr Savr™ occupancy/vacancy sensors are wireless, battery-powered, passive infrared (PIR) sensors that automatically control lights via RF communication to compatible dimming and switching devices. These sensors detect the heat (IR radiation of 9.5 µm) from people moving within an area to determine when the space is occupied. The sensors then wirelessly transmit the appropriate commands to the associated dimming and switching devices to turn the lights on or off automatically. They combine both convenience and exceptional energy savings potential along with ease of installation.



Features

- Wireless occupancy sensor has 3 settings available: Auto-On/Auto-Off, Auto-On Low-Light/Auto-Off, and Manual-On/Auto-Off
- Auto-On Low-Light feature will turn lights on automatically only if there is less than approximately 10 Lux (1 fc) of ambient light
- Vacancy-only model available to meet California (U.S.A.) Title 24 requirements
- Uses Clear Connect® technology
- Passive infrared motion detection with exclusive Lutron® XCT™ Technology for fine motion detection
- 360˚ coverage ranges from 324 ft^2 (30.2 m^2) to 676 ft^2 (62.4 m^2), depending on mounting height
- Simple and intuitive adjustments available for Timeout, Auto-On, and Activity settings
- Supports advanced occupancy features, such as dependent occupancy groups and customizable occupied/unoccupied presets in some systems
- Multiple sensors can be added for extended coverage. Refer to product specification submittal of receiving device to determine system limits
- Lens illuminates during test mode to verify ideal locations
- Multiple ceiling-mount methods available for different ceiling materials
- Front accessible test buttons make programming easy
- 10-year battery life design
- RoHS compliant

Models Available

- LRF__-OCR2B-P-WH
  - Color Code
  - Occupancy and Vacancy
  - Frequency/Channel Code
- LRF2-VCR2B-P-WH
  - Vacancy Only
  - Available for Channel Code 2 Only

Frequency/Channel Codes

Available

2 = 431.0–437.0 MHz (U.S.A., Canada, Mexico, Brazil)
3 = 868.125–869.850 MHz (Europe, U.A.E.)
4 = 868.125–868.4755 MHz (China, Singapore)
5 = 865.5–866.5 MHz (India)
6 = 312.3–314.8 MHz (Japan)
7 = 433.05–434.79 MHz (Hong Kong, Macau)

Color Code

WH = White

Compatible RF Devices

- For use with Lutron® products only
- Communicates to various wireless Lutron® systems*

* Contact Lutron® Customer Service at www.lutron.com for frequency/channel code compatibility with your particular geographic region, and for integrating with other Lutron® lighting and shading products.

Job Name:	Model Numbers:	
Job Number:		

Specifications

Regulatory

- Lutron® Quality Systems Registered to ISO 9001:2008

Standards Approved

LRF2- (USA and Canada)

- cULus Listed
- FCC certified
- IC certified
- Meets CA (U.S.A.) Energy Commission Title 24 requirements
- COFETEL
- ANATEL
- SUTEL

LRF3-

- CE marked (European Union)
- TRA type approval (United Arab Emirates)
- CITC type approval (Saudi Arabia)

LRF4-

- SRRC type approval (Mainland China)
- iDA registered (Singapore)

LRF5-

- WPC Type (India)

LRF6-

- 007YUUL0689

LRF7-

- FCC

Power/Performance

- Operating voltage: 3 V⎓
- Operating current: 14 µA nominal
- Requires one CR 123 lithium battery
- 10-year battery life
- Non-volatile memory (saved changes are stored during power loss)

Environment

- Temperature: 32 ˚F to 104 ˚F (0 ˚C to 40 ˚C)
- For indoor use only

Warranty

- 5-Year Limited Warranty. For additional Warranty information, please visit www.lutron.com/TechnicalDocumentLibrary/Sensor_Warranty.pdf

Range

LRF2-, LRF3-, LRF4-, LRF5-, LRF7-

Local load controls must be located within 60 ft (18 m) line-of-sight, or 30 ft (9 m) through walls, of a sensor.

LRF6-

Local load controls must be located within 40 ft (12.2 m) line-of-sight, or 23 ft (7 m) through walls, of a sensor.

Sensor Coverage Test

- Front accessible test button
- Lens illuminates orange in response to motion during test mode and is visible from 60 ft (18 m)

Wireless Communication Test

- Front accessible test button
- Turn associated loads on and off

Timeout Options

- 1 minute*
- 5 minutes
- 15 minutes (default setting)
- 30 minutes

Auto-On Options (Occupancy Versions Only)

- *Enabled*: Sensor turns lights ON and OFF automatically (default setting).
- *Low Light*: Sensor turns lights ON automatically only in low ambient light conditions; sensor turns lights OFF automatically.
- *Disabled***: Lights must be turned ON manually from dimming or switching device; sensor turns lights OFF automatically.

Activity Options

- *Low Activity*: (default setting)
- *Medium Activity*:
- *High Activity*:

* Intended for use in high-activity, briefly occupied areas only.

** During the 15-second grace period that begins when the lights are automatically turned off, the lights will automatically turn back on in response to motion. This grace period is provided as a safety and convenience feature in the event the lights turn off while the room is still occupied, so that the user does not need to manually turn the lights back on. After 15 seconds, the grace period expires and the lights must be manually turned on.

Job Name:	Model Numbers:	
Job Number:		

Installation Overview

Sensor Setup

- Sensor setup is available as a service by Lutron. For more information see the Sensor Layout and Tuning service document (Lutron® P/N 3601235).

Sensor Placement

- To detect motion, the sensor requires line-of-sight of room occupants. The sensor must have an unobstructed view of the room. DO NOT mount behind or near tall cabinets, shelves, hanging fixtures, ceiling fans, etc. The sensor cannot see through glass objects such as patio- or shower doors.
- Hot objects and moving air currents can affect the performance of the sensor. To ensure proper operation, the sensor should be mounted at least 4 ft (1.2 m) away from HVAC vents and light bulbs that are below the ceiling line.
- The performance of the sensor depends on a temperature differential between the ambient room temperature and that of room occupants. Warmer rooms may reduce the ability of the sensor to detect occupants.
- Devices emitting Radio Frequency (RF) energy can affect the performance of sensors. To ensure proper operation, sensors should be mounted at least 4 ft (1.2 m) away from devices that emit radio waves (e.g., microwave ovens, wireless routers or other wireless devices).
- For additional information on placing sensors, please see the Occupancy/Vacancy Sensor Design and Application Guide (P/N 368-3197) located at www.lutron.com.

Mounting

Temporary mounting is optional to test sensor coverage and wireless communication before permanently installing the sensor.

Drop Ceiling (Compressed Fiber Ceiling Tile)

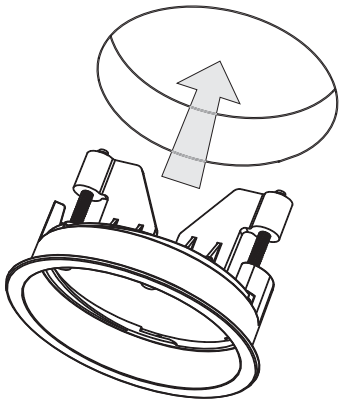
The mounting wire is provided for both temporary and permanent mounting of the sensor to ceiling tiles. It is designed to allow temporary mounting, testing, and repositioning (if necessary) of the sensor without damaging a ceiling tile. Once the final position of the sensor has been chosen, the mounting wire should be twisted together to permanently secure the sensor in place.

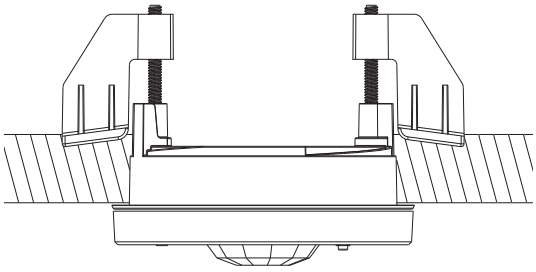
Solid Ceiling (Drywall, Plaster, Concrete, or Wood)

- Temporary mounting: Ten (10) temporary mounting strips can be purchased in the kit, L-CMDPIRKIT, for temporarily mounting and testing the sensor.
- Permanent mounting: Screws and anchors (for drywall or plaster) provided to mount the sensor.

Recess-Mount

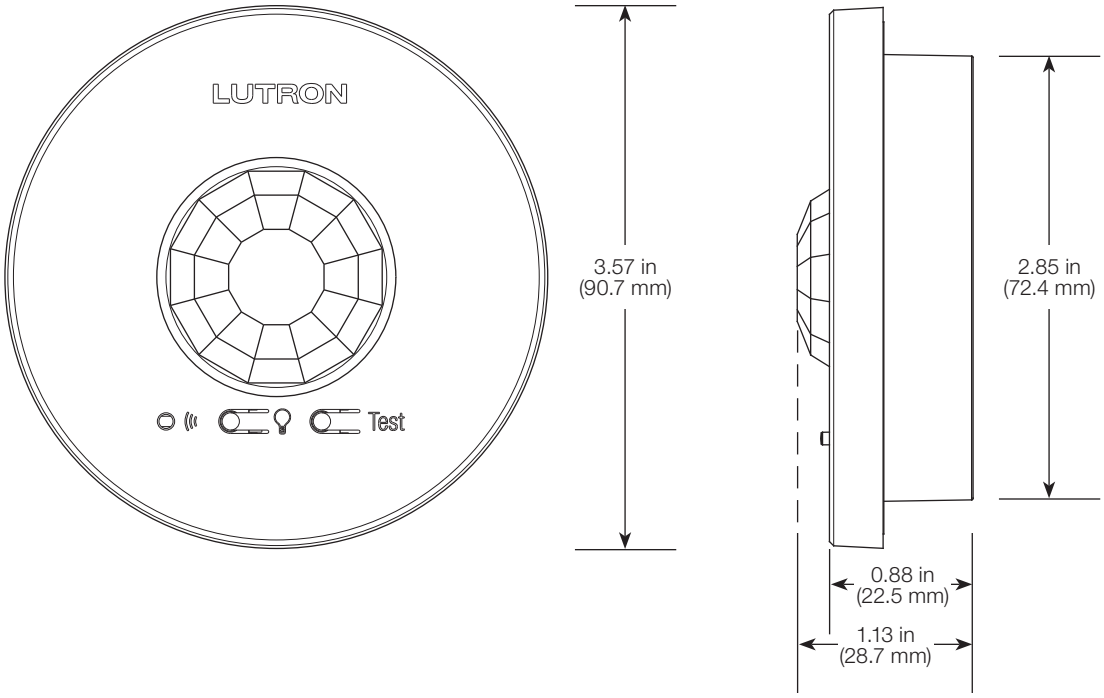
- Do not recess-mount sensor in a metal surface.
- Recess-mounting ring requires an opening of 3 in (76 mm) in diameter.
- Recess-mounting ring secures internally to ceiling. Sensor twists into the recess mounting ring and sits flush with ceiling (see image below).
- Recess-mounting ring purchased as a separate kit: L-CRMK-WH.





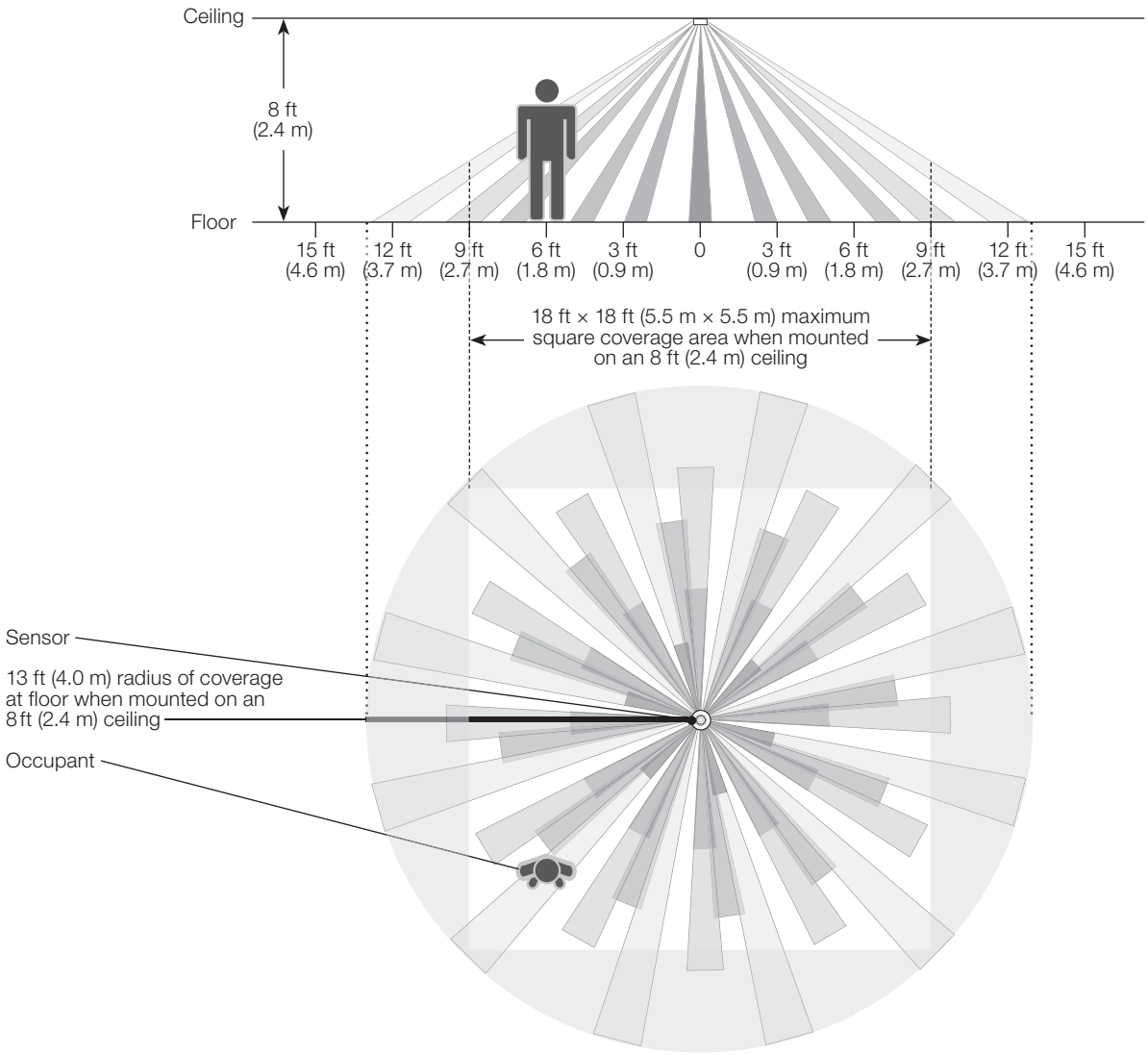
Job Name:	Model Numbers:	
Job Number:		

Dimensions



Job Name:	Model Numbers:	
Job Number:		

Range Diagrams



Sensor Coverage Chart (for sensor mounted in center of room)

Ceiling Height	Maximum Square Coverage Area*	
8 ft (2.4 m)	18 ft × 18 ft (5.5 m × 5.5 m)	324 ft^2 (30.2 m^2)
9 ft (2.7 m)	20 ft × 20 ft (6.1 m × 6.1 m)	400 ft^2 (37.2 m^2)
10 ft (3.0 m)	22 ft × 22 ft (6.7 m × 6.7 m)	484 ft^2 (44.9 m^2)
12 ft (3.7 m)	26 ft × 26 ft (7.9 m × 7.9 m)	676 ft^2 (62.4 m^2)

* 12 ft (3.7 m) is the recommended maximum mounting height

Job Name:	Model Numbers:	
Job Number:		

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Wireless Wall-Mount Sensor

Lutron® wall-mounted occupancy and vacancy sensors are wireless, battery-powered, passive infrared (PIR) sensors that automatically control lights via RF communication to compatible dimming or switching devices. These sensors detect the heat from people moving within an area to determine when the space is occupied. The sensors then wirelessly transmit the appropriate commands to the associated dimming or switching devices to turn the lights on or off automatically. They combine both convenience and exceptional energy savings along with ease of installation.



Features

- Wireless occupancy/vacancy sensor has 2 settings available: Auto-On/Auto-Off, and Manual-On/Auto-Off
- Vacancy model meets CA Title 24 requirements
- Passive infrared motion detection with exclusive Lutron® XCT™ Technology for fine motion detection
- 180° field of view model:
  - Minor motion = 1500 ft^2 (139.4 m^2)
  - Major motion = 3000 ft^2 (278.7 m^2)
- 90° field of view model:
  - Minor motion = 1225 ft^2 (113.8 m^2)
  - Major motion = 2500 ft^2 (232.3 m^2)
- Hallway model with long, narrow field of view:
  - Major motion = coverage of up to 150 ft (45.7 m)
- Simple and intuitive adjustments available for Timeout, Activity, and Auto-On settings
- Accessible test buttons make setup easy
- Lens illuminates during test mode to verify ideal locations
- Multiple sensors can be added for extended coverage; refer to product specification submittal of receiving device to determine system limits
- 10-year battery life design
- RoHS compliant

Compatible RF Devices

- For use with Lutron® products only
- Communicates to various wireless Lutron® Clear Connect® systems*

* Contact Lutron Customer Service at www.lutron.com for frequency/channel code compatibility with your particular geographic region, and for integrating with other Lutron® lighting and shading products.

Models Available

- LRF__-__ __ LB-P-WH
  - Coverage Type
  - Sensor Type
  - Frequency/Channel Code

Example:
LRF**2**-**VH**LB-P-WH
(434 MHz White Hallway Vacancy Sensor)

Frequency/Channel Code

2 = 431.0 – 437.0 MHz (US, Canada, Mexico, Brazil)*
3 = 868.125 – 869.850 MHz (Europe, UAE)
4 = 868.125 – 868.475 MHz (China, Singapore)
5 = 865.5 – 866.5 MHz (India)
7 = 433.0 – 433.7 MHz (Hong Kong, Macau)

Sensor Type

O = Occupancy/Vacancy (Auto-On/Auto-Off)
V = Vacancy (Manual-On/Auto-Off)**

Coverage Type

H = Hallway
K = 90° Corner-Mount
W = 180° Wall-Mount

* BAA compliant models available for LRF2 configurations. Add a "U" prefix to your chosen model number. Example: **U**LRF2-OWLB-P
** Vacancy sensor type for LRF2 models only

Job Name:	Model Numbers:	
Job Number:		

Specifications

Regulatory

- Lutron® Quality Systems Registered to ISO 9001:2008

Regulatory Approvals

LRF2-

- cULus® listed
- FCC certified
- IC certified
- COFETEL certified
- ANATEL certified
- SUTEL certified
- Meets CA (U.S.A.) Energy Commission Title 24 requirements

LRF3-

- CE marked (European Union)
- TRA type approved (United Arab Emirates)
- CITC type approved (Saudi Arabia)

LRF4-

- SRRC type approved (Mainland China)
- iDA registered (Singapore)

LRF5-

- WPC type approved (India) [expected Q1 2014]

Power/Performance

- Operating voltage: 3 V⎓
- Operating current: 14 µA nominal
- Requires one CR 123 lithium battery
- 10-year battery-life design
- Non-volatile memory (saved changes are stored during power loss)

Environment

- Temperature: 32 °F to 104 °F (0 °C to 40 °C)
- For indoor use only

  Note: For unconditioned environments where the air temperature may approach the temperature of the occupants, additional sensors will be needed to achieve the same coverage. This is true of any sensor that relies exclusively on passive infrared technology.

Warranty

- 5-Year Limited Warranty. For additional Warranty information, please visit www.lutron.com/TechnicalDocumentLibrary/Sensor_Warranty.pdf

RF Range

- Distance between local load controls and sensor should not exceed 60 ft (18 m) line-of-sight or 30 ft (9 m) through walls.

Sensor Coverage Test

- Dedicated test button
- Lens illuminates orange in response to motion during test mode

Wireless Communication Test

- Dedicated test button
- Turn associated loads on and off

Timeout Options

- 1 minute*
- 5 minutes
- 15 minutes (default setting)
- 30 minutes

Auto-On Options (Occupancy Versions Only)

- *Enabled*: Sensor turns lights ON and OFF automatically (default setting)
- *Disabled***: Lights must be turned ON manually from dimming or switching device. Sensor turns lights OFF automatically

Sensitivity Options

- *Low Activity*: (default setting)
- *Medium Activity*:
- *High Activity*:

* Intended for use in high-activity, briefly-occupied areas only

** There is a 15-second grace period that begins when the lights are automatically turned off, during which the lights will automatically turn back on in response to motion. This grace period is provided as a safety and convenience feature in the event the lights turn off while the room is still occupied, so that the user does not need to manually turn the lights back on. After 15 seconds, the grace period expires and the lights must be manually turned on.

Job Name:	Model Numbers:	
Job Number:		

Installation Overview

Sensor Placement

- The mounting height of the sensor should be between 6 ft and 8 ft (1.6 m and 2.4 m).
- For smaller rooms less than 12 ft × 12 ft (3.7 m × 3.7 m), detection may be improved by mounting the sensor at 6 ft (1.8 m) from the floor.
- The ability to detect motion requires that the sensor have line-of-sight of all room occupants. The sensor must have an unobstructed view of the room. **DO NOT** mount behind or near tall cabinets, shelves, hanging fixtures, etc. The sensor cannot detect occupants through glass objects such as patio or shower doors.
- Hot objects and moving air currents can affect the performance of the sensor. To ensure proper operation, the sensor should be mounted at least 4 ft (1.2 m) away from light bulbs and HVAC vents.
- The performance of the sensor depends on a temperature differential between the ambient room temperature and that of room occupants. Warmer rooms may reduce the sensor's ability to detect occupants.
- Distance between local load controls and sensor should not exceed 60 ft (18 m) line-of-sight or 30 ft (9 m) through walls.

Job Name:	Model Numbers:	
Job Number:		

Mounting

- 180° and hallway sensors mount directly to wall with mounting bracket (included). See Figure A.
- 90° sensors mount directly in corner or on wall offset away from corner with mounting bracket (included). See Figure B.
  - Temporary mounting is recommended to test sensor coverage and wireless communication before permanently installing the sensor.
    - Temporary mounting: A 3M™ Command™ adhesive strip is provided for temporarily mounting and testing the sensor. This strip is designed for easy, damage-free removal and is not reusable.
    - Permanent mounting: Mounting bracket, screws, and anchors are provided to mount sensor.
- The Flexible Mounting Armature, LRF-ARM-WH (purchased separately), allows sensors to be mounted at greater heights on a ceiling, wall, or other flat surface.
  - The ball-and-clamp design expands the coverage area for Lutron® standard wall-, corner-, or hall-mount sensors. See Figure C.
  - Common mounting areas: warehouse aisles, loading docks, long hallways.

Figure A. 180° Wall-Mount Sensor and Hallway Sensor

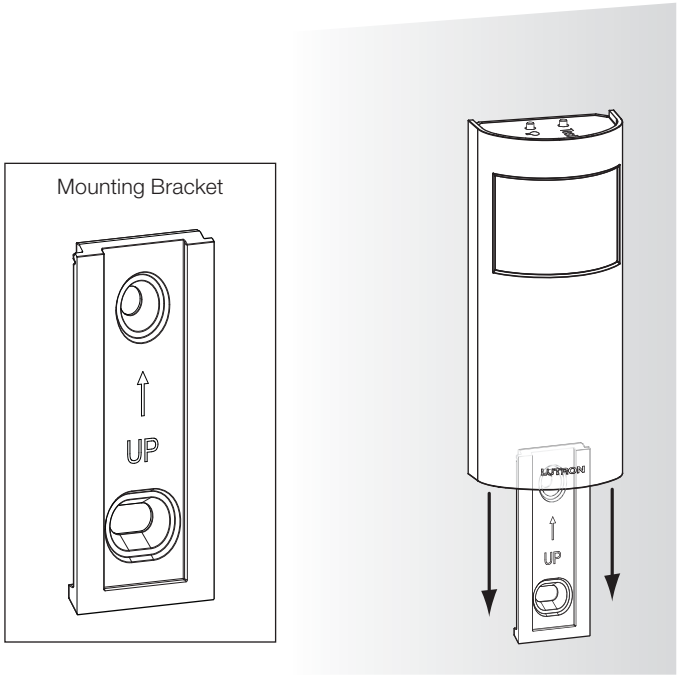


Figure B. 90° Corner-Mount Sensor

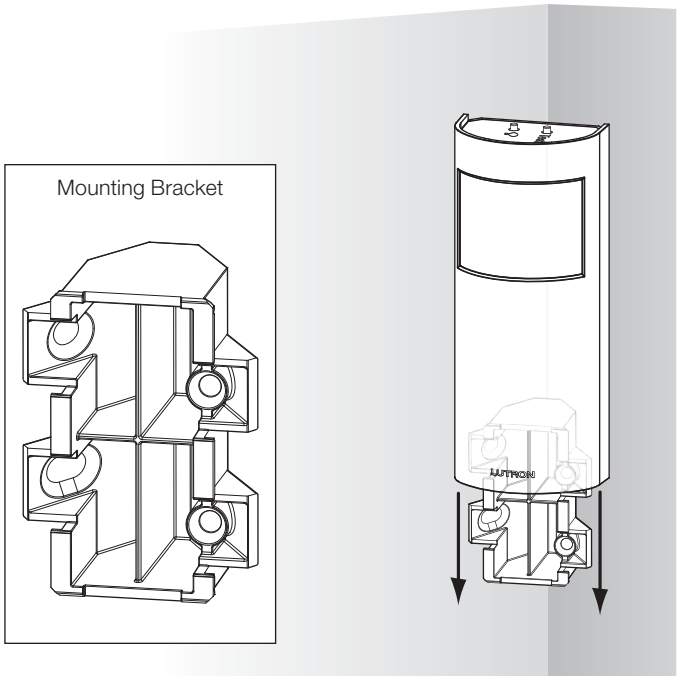
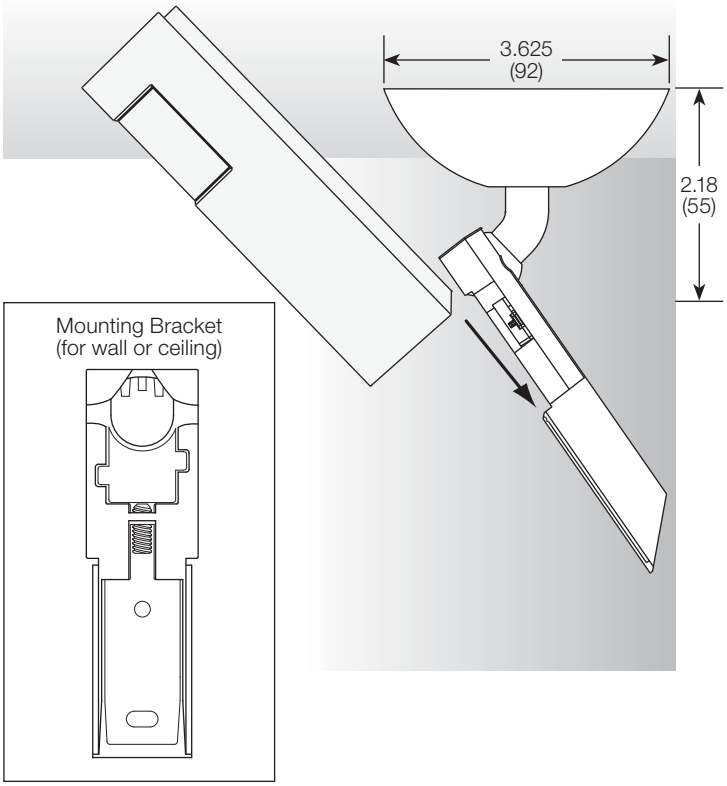


Figure C. Flexible Mounting Armature
Measurements are: in (mm)

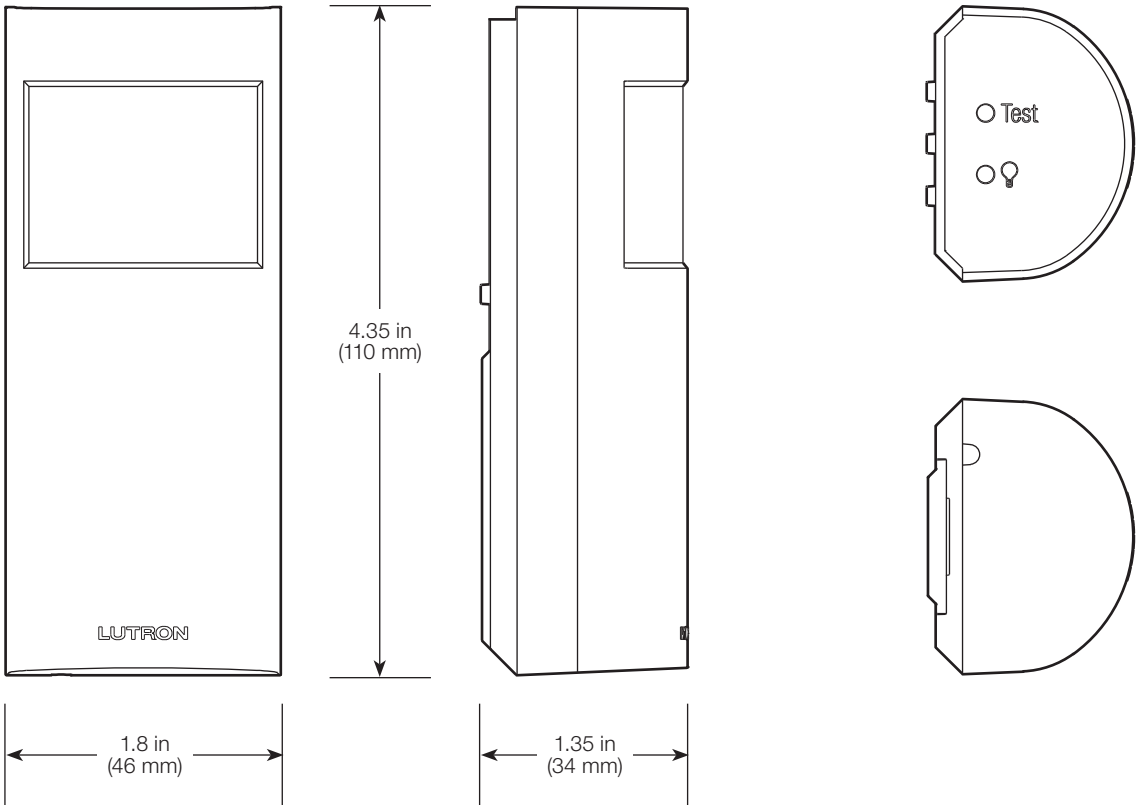


3M and Command are trademarks of 3M Company.

Job Name:	Model Numbers:	
Job Number:		

369481i 5 01.13.15

Dimensions



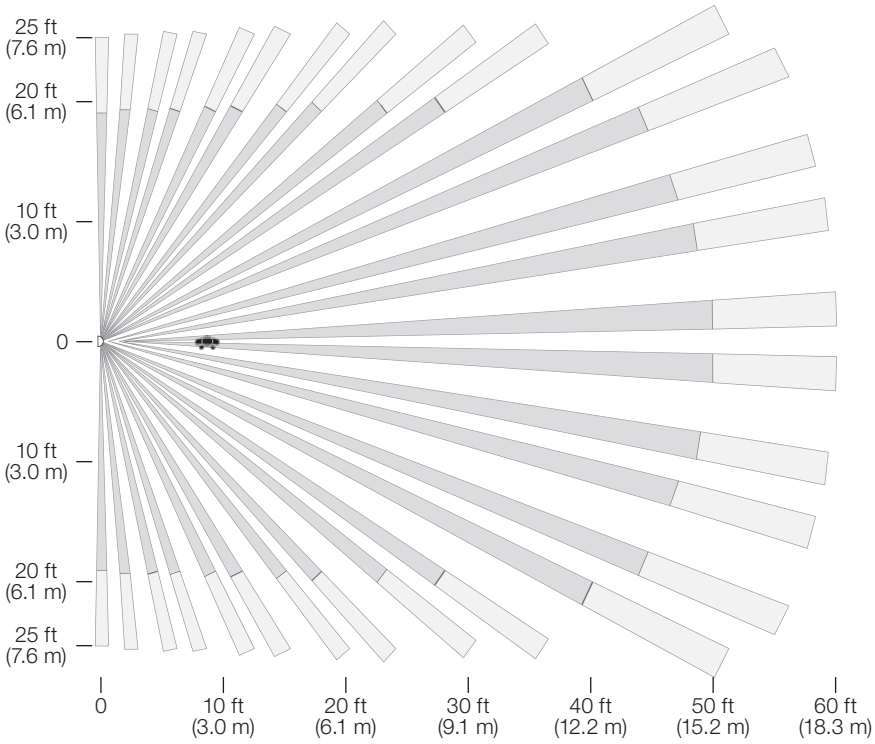
Job Name:	Model Numbers:	
Job Number:		

Coverage Diagrams

180° Wall-Mount Sensors

Models: LRFX-OWLB-P-WH and LRFX-VWLB-P-WH

Horizontal Beam Diagram

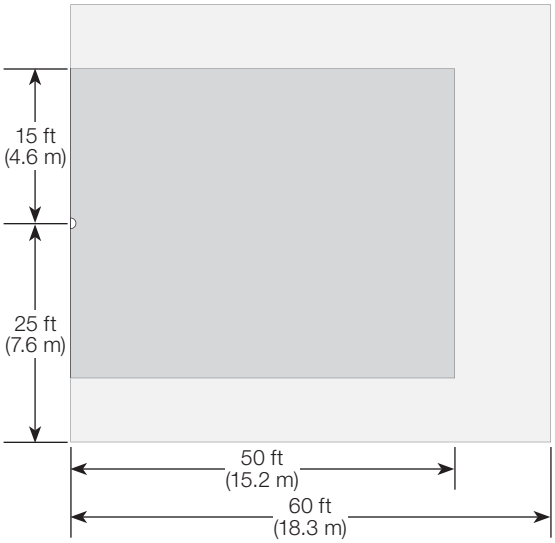


Tested Coverage Area

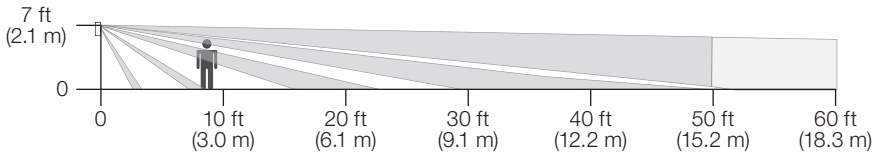
Major motion coverage: 3000 ft^2 (278.7 m^2)

Minor motion coverage: 1500 ft^2 (139.4 m^2)

Compliant to NEMA WD7 test grid (shown below)



Vertical Beam Diagram*



* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 ft and 8 ft (1.6 m and 2.4 m).

Job Name:	Model Numbers:	
Job Number:		

Maestro Wireless Switches

Models Available

Switches

Lighting and motor loads

MRF2-6ANS-XX [1]	6 A Lighting/3 A Fan (1/10 HP motor), Electronic Switch 120 V~
MRF2-8ANS-120-XX [1,2]	8 A Lighting, 5.8 A Fan (1/4 HP motor), Spec-Grade Electronic Switch 120 V~
MRF2-8S-DV-XX [2,3]	8 A Lighting, 3 A Fan (1/10 HP motor, 120 V~ only), Spec-Grade Electronic Switch 120–277 V~, no neutral wire required

Switch



Companion Switches

Claro Gloss Finishes

MA-AS-XX [2]	Companion Switch 120 V~
MA-AS-277-XX [2]	Companion Switch 277 V~

Satin Colors Satin Finishes

MSC-AS-XX	Companion Switch 120 V~
MSC-AS-277-XX	Companion Switch 277 V~

Companion Switch



NOTE: "XX" in the model number represents color/finish code.

1 Neutral wire required

2 BAA-compliant model numbers available. Add a "U" prefix to the model number

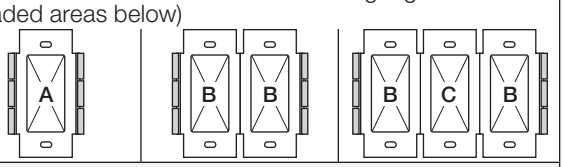
3 May require LUT-MLC (included with MRF2-8S-DV models) to ensure proper function with low-wattage load types. See page 12 for details.

Job Name:	Model Numbers:	
Job Number:		

Switch Load Type and Capacity

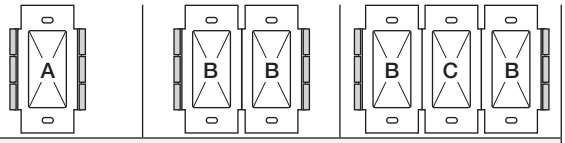
Neutral Required

Do not remove outside fins on ends of ganged controls (shaded areas below)



Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2-8ANS-120 [1,2,5]	120 V~	Lighting	25 W	8 A	6.5 A	5 A
		Fan Motor	0.2 A	1/4 HP (5.8 A)	1/4 HP (5.8 A)	1/6 HP (4.4 A)
MRF2-6ANS [1]	120 V~	Lighting	25 W	6 A	5 A	3.5 A
		Fan Motor	0.2 A	1/10 HP (3 A)	1/10 HP (3 A)	1/10 HP (3 A)

No Neutral Required



Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2-8S-DV [1,5]	120–277 V~	Incandescent/Halogen	25 W	8 A	8 A/7 A[4]	7 A
	120–277 V~	Fluorescent/LED/CFL	40 W (LUT-MLC)[3]	8 A	8 A/7 A[4]	7 A
	120 V~	Fan Motor	0.4 A	1/10 HP (3 A)	1/10 HP (3 A)	1/10 HP (3 A)

1 Switch Load Type:
- MRF2-8ANS-120 is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/4 HP (5.8 A).
- MRF2-6ANS is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/10 HP (3 A).
- MRF2-8S-DV is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/10 HP (3 A, 120 V~ only).

2 For loads larger than 8 A (120 V~), the MRF2-8ANS-120 switch can be used with the PHPM-SW-DV-WH power booster.

3 The LUT-MLC ensures proper function with low-wattage fluorescent, CFL, and LED load types. See page 12 for details.

4 Maximum load for double-gang application is 8 A. Triple-gang application derates maximum load to 7 A.

5 BAA-compliant model numbers available. Add a “U” prefix to the model number.

Job Name:	Model Numbers:	
Job Number:		

Catalog Number: | Date: | Project:

OVERVIEW

The WSD is a stylish, easy to install, and simple to use Wall Switch Decorator style Passive Infrared (PIR) sensor. It is ideal for private offices, copy rooms, closets, or any small enclosed space without obstructions. A user programmable time delay ensures that once the room is vacated the sensor will time out and turn off the lights. Additionally, the WSD sensor has several On Modes and Switch Modes that can be programmed using the front push-button. For rooms with obstructions, the Dual Technology WSD PDT Series sensor is recommended. Additionally, all WSD Family sensors have a patent-pending wiring method that enables them to function either with or without a neutral connection. WSD units come pre-configured for wiring without a neutral; however, if connection to neutral is required by code, contractors can convert the unit in seconds.

FEATURES

- Compatible w/LEDs, electronic & magnetic ballasts, CFLs, & incandescents
- 100% passive detection, no potential for interference with other building systems
- Small motion detection to 20 ft
- Push-button programmable without removing cover plate - adjustable time delays & operating modes
- Dual technology (PDT) utilizes PIR/Microphonics detection (patented)
- Self-grounding mounting strap
- Device accommodates powering over ground or neutral connection (patent pending)
- Ultra low current leakage (<0.5 mA) when connected via ground
- Fully meets NEC 2011 Section 404.2C neutral requirements - no current leakage to ground when connected to neutral
- Line power and load wires are interchangeable - impossible to wire backwards (patented)

Warranty

Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

AcuityControls™

Sensor Switch™

WSD Family



WSD
WSD PDT



WSD 2P
WSD PDT 2P

ORDERING INFORMATION

WSD SINGLE RELAY

Series		Operating Mode[1]		Voltage		Color[3]				Temp / Humidity	
WSD	Passive Infrared (PIR)	[blank]	Auto-on (default) or vacancy	[blank]	120/277VAC	WH	White	AL	Lt. Almond	[blank]	Standard
WSD PDT	Dual Technology (PIR/ Microphonics)	SA	Vacancy (default) or auto-on	347[2]	347VAC	IV	Ivory	BK	Black	LT	Low Temp/ High Humidity
		VA	Vacancy only			GY	Gray				

WSD DUAL RELAY

Series		Operating Mode[1]		Voltage		Color[3]				Temp / Humidity	
WSD 2P	Passive Infrared (PIR)	[blank]	Pole 1 auto-on Pole 2 vacancy	[blank]	120/277VAC	WH	White	AL	Lt. Almond	[blank]	Standard
WSD PDT 2P	Dual Technology (PIR/ Microphonics	2SA	Both poles vacancy (default)	347[2]	347VAC	IV	Ivory	BK	Black	LT	Low Temp/ High Humidity
						GY	Gray				

Notes:
1. Operating Modes reprogrammable via push-button except for VA version
2. Wall plates included in white or ivory only for 347 VAC units
3. Matching wall plate provided for 120/277 VAC units

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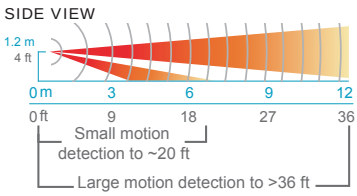
SPECIFICATIONS

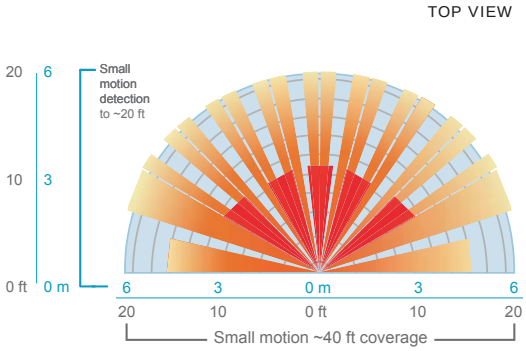
Size:	2.74"H x 1.68"W x 1.63"D (not including ground strap)
Weight:	5 oz
Mounting:	Single gang switch box
Mounting Height:	30-48 in
Maximum Load/ Pole:	(Relay) 800W @ 120VAC, 1200W @ 277VAC, 1500 W @ 347VAC
Minimum Load:	None
Motor Load:	1/4 HP
Frequency:	50/60Hz (timers are 1.2x for 50Hz)
Temperature Rating:	0°C-60°C

ROHS compliant

COVERAGE PATTERNS

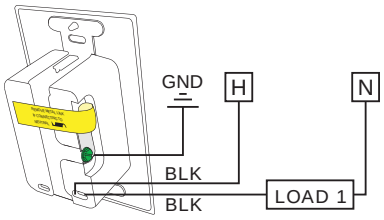
- Small motion (e.g., hand movements) detection up to 20 ft (6.10 m), ~625 ft²
- Large motion (e.g., walking) detection greater than 36 ft (10.97 m), ~2025 ft²
- Wall-to-Wall coverage
- Passive Dual Technology (Microphonics) provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is utilized to prevent non-occupant noises from keeping the lights on.





WIRING TO GROUND (no NEUTRAL)

SINGLE RELAY



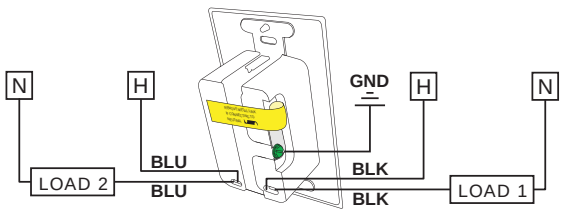
WIRE COLOR KEY

120/277 VAC WIRING

BLACK*	- Line 1 Input	*BLACK wires can be reversed
BLACK*	- Load 1 Output	
BLUE*	- Line 2 Input	*BLUE wires can be reversed
BLUE*	- Load 2 Output	

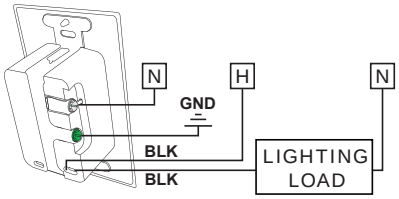
347 VAC WIRING (-347 Option)
Red wires replace Black wires.

DUAL RELAY

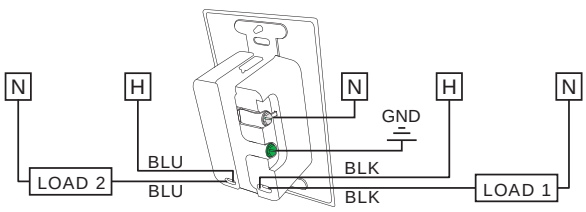


WIRING TO NEUTRAL

SINGLE RELAY



DUAL RELAY



Notes:
- Unit will draw power from either line connection.
- When switching 277 VAC or 347 VAC on both relays, the line inputs must be of the same phase.

Acuity Brands | One Lithonia Way Conyers, GA 30012 Phone: 800.535.2465 www.acuitycontrols.com
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sensorswitch®

CM 6



HIGH BAY 360º SENSOR
CEILING MOUNT • LOW VOLTAGE • PASSIVE INFRARED (PIR)

SPECIFICATIONS

FEATURES
100% Digital PIR Detection,
Excellent RF Immunity
360º Coverage Pattern
Up to 45 ft Mounting
Push-Button Programmable
User Adjustable Time Delays
No Field Calibration or Sensitivity
Adjustments Required
Convenient Test Mode
100 hr Lamp Burn-in Timer
Green LED Indicator

LAMPMAXIMIZER® TECHNOLOGY
- Protects Lamp Life while Maximizing Energy Savings
- Minimum On Timer (15 min default)
- Occ. Time Delay (10 min default)
- LampMaximizer+ Mode - Optimizes Lamp Life & Energy Savings (disabled by default)
- Switch Counter (in 1000's)
- Total Lamp On Time (in khrs)

PHYSICAL SPECS
SIZE 4.55" Dia. (11.56 cm)
1.55" Deep (3.94 cm)
WEIGHT 6 oz
MOUNTING
Ceiling Tile Surface
3.5" Octagon Box
Single Gang Handy Box
COLOR White

ELECTRICAL SPECS
OPERATING VOLTAGE
12-24 VAC/VDC
CURRENT DRAW
Standard, 4 mA
w/ **R** option, 16 mA
DIMMING LOAD Sinks < 20mA;
~40 Ballasts @ .5mA each
RECOMMENDED POWER PACK
PP20

ENVIRONMENTAL SPECS
OPERATING TEMP
14º to 160º F (-10º to 71º C)
RELATIVE HUMIDITY
20 to 90% non-condensing
SILICONE FREE
ROHS COMPLIANT

OVERVIEW
Designed for mounting heights of up to 45 ft (13.72 m), the **CM 6** High Bay 360º sensor provides Passive Infrared (PIR) occupancy detection over a 15-20 ft (4.57- 6.10 m) radial coverage pattern that overlaps the areas lit by a typical high bay fixture. Applications include warehouses, racquetball courts, and gymnasiums. Multiple fixture control is best handled by using multiple **CM 6** sensors together as needed. When used with standard power packs, these sensors are ideal for on/off control of T5/T8 fluorescent lighting. However, HID bi-level fixtures can also be controlled when the **CM 6** is partnered with a **PP20 SH** power pack with the start-to-high feature. For lower mounting height applications, **CM 9** or **CM 10** Series sensors are recommended.

SENSOR OPERATION
The sensor detects changes in the infrared energy given off by occupants as they move within the field-of-view. When occupancy is detected, a DC output goes high and can drive up to 200 mA of connected load. The sensor is powered with 12-24 VAC/VDC and typically operates with a **PP20** or **MP20** power pack, enabling complete 20 Amp circuits to be controlled. This innovative sensor requires no field calibration or sensitivity adjustments.

LAMPMAXIMIZER®
This sensor also contains patent pending LampMaximizer technology that allows users to aggressively target energy savings while still protecting lamp life. A minimum on timer, factory set at 15 minutes, helps preserve lamp life by eliminating all lamp cycles shorter than lamp manufacturers' recommedations specify.

A standard occupancy time delay is also present that ensures lights turn off (assuming minimum on timer has elapsed) if no occupancy is detected. This timer is factory set at 10 minutes to promote energy savings, but is adjustable between 30 seconds and 20 minutes. These adjustments can be done manually, through the unit's push-button, or automatically every two weeks through an advanced mode, called LampMaximizer+, that determines the optimum time delay in order to maximize both lamp life and energy savings. Additionally, this sensor maintains statistics on total lamp on time and number of cycles.

OPTIONS

LOW VOLTAGE RELAY (R)
- Enables sensors to interface with other systems (e.g., BMS, lighting panels)
- Provides dry contact closure via a SPDT, 1 Amp, 40 Volt relay
- Only one relay needed per zone
- Changes state when all connected sensors register unoccupied
- Relay requires sensor power to function

OCCUPANCY CONTROLLED DIMMING (D)
- Provides dimming output to control 0-10 VDC dimmable ballasts
- Provides a second occupancy time-out period that enables the lights to go to a dim setting before turning off
- Adjustable max/min dim setting
- Only one sensor per zone needs to have dimming output

PHOTOCELL (P)
- Auto set-point calibration
- Two selectable modes of operation
- On/Off mode: Photocell has full control during periods of occupancy
- Inhibit mode: Photocell can prevent lights from turning on if adequate daylight is available, but cannot turn lights off

LOW TEMP/HIGH HUMIDITY (LT)
- Sensor is corrosion resistant to moisture
- Operates down to -40º F/C

c UL US LISTED

TITLE 24
ASSEMBLED in U.S.A.
5 YEAR WARRANTY

ORDERING INFO

CM 6 [RELAY] [DIMMING/PHOTOCELL] [TEMP/HUMIDITY]

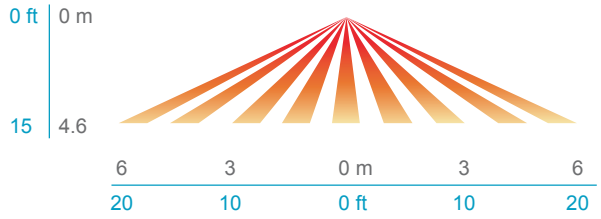
RELAY	DIMMING / PHOTOCELL *CHOOSE ONE ONLY*	TEMP/HUMIDITY
Blank = None	**Blank = None**	**Blank = Standard**
R = Low Voltage Relay	**D = Occupancy Controlled Dimming**	**LT = Low Temp**
	P = Photocell	

COVERAGE PATTERN

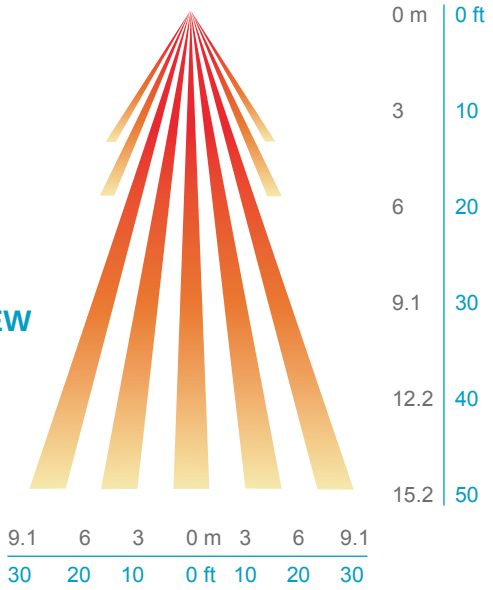
6 HIGH BAY 360º LENS

- Best choice for 15 to 45 ft (4.57 to 13.72 m) mounting heights
- 15 to 20 ft (4.57 to 6.10 m) radial coverage overlaps area lit by a typical high bay fixture
- Excellent detection of large motion (e.g. **walking**) up to a 35 ft (10.76 m) mounting height
- Excellent detection of extra large motion (e.g. **forklifts**) up to a 45 ft (13.72 m)mounting height

LOW VIEW



HIGH VIEW



WIRING (DO NOT WIRE HOT)

STANDARD WIRING

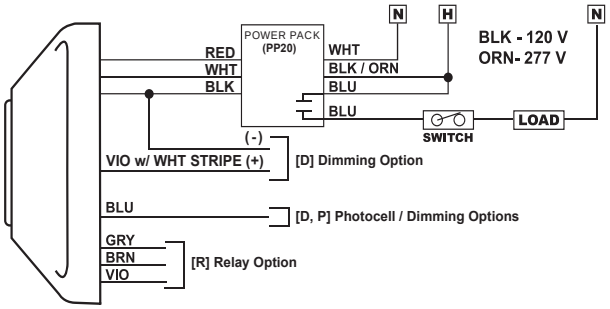
RED - Power Input (12-24 VAC/VDC)
BLACK - Common
WHITE - Occupancy State (high VDC for occupied)

PHOTOCELL/DIMMING OPTIONS (D, P)

BLUE - Direct output to power pack for providing photocell control and/or secondary dim time out. Output is high VDC with occupancy & low light. Output also held high during secondary dim time out. For multi-level control, use two power packs and connect White wire to primary load and Blue to daylight load.

VIOLET w/ WHITE STRIPE - Connect to 0-10 VDC control wire (typically Violet) from 0-10 VDC dimmable ballast

GRAY from Ballast - Connect to sensor Black wire

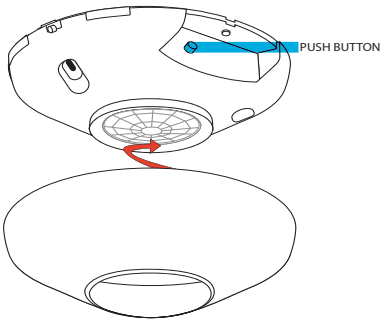


RELAY OPTION (R)

GRAY / BROWN - Connected during occupied state
VIOLET / BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state

INSTALLATION

- Mount sensor directly to a ceiling tile or a metallic grid (two self-tapping screws provided).
- Sensor's mounting holes also align with 3.5" octagon or single gang handy box (screws not provided).
- Sensor will detect motions crossing segments more effectively than motions parallel to beams.
- For optimal detection, position sensor such that segments are crossed upon entrance and unable to view outside the space.



PROGRAMMING

Refer to instruction card IC7.001 for default settings and directions on programming the sensor via the push-button.

WARRANTY: Sensor Switch, Inc. warrants these products to be free of defects in manufacture and workmanship for a period of 60 months. Sensor Switch, Inc., upon prompt notice of such defect, will, at its option, provide a Returned Material Authorization number and repair or replace returned product.
LIMITATIONS AND EXCLUSIONS: This Warranty is in full lieu of all other representation and expressed and implied warranties (including the implied warranties of merchantability and fitness for use) and under no circumstances shall Sensor Switch, Inc. be liable for any incidental or consequential property damages or losses.

sensorswitch®
An AcuityBrands Company

TS-CM-002A

900 Northrop Road, Wallingford, CT 06492 • 1.800.PASSIVE • FX 203.269.9621 • www.sensorswitch.com

SINCE 1945 KEYSTONE | DIRECTDRIVE LED LINE VOLTAGE T5 TUBES

KT-LED13T5HE-48GC-840-D

T5 LED LAMP

DESCRIPTION

13W T5 LED | 4000K | >80 CRI | High Efficiency

RoHS Compliant 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T5 LED
BASE TYPE: G5 (Miniature Bi-Pin)
WATTAGE: 13W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years



PRODUCT FEATURES

- Listed on DLC QPL
- Replacement for Conventional Fluorescent Lamp
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Direct Replacement for F28T5 Fluorencent Lamp
- Frosted Lens Eliminates Pixelation
- UL Classified
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- Integral Driver (Isolated), Eliminates the Need for External Driver or Ballast
- 120+ Lumens per Watt
- Improved Lamp Durability with Shatterproof Coated Glass
- ETL Sanitation Listed NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	13W	>0.9	0.11A @ 120V 0.05A @ 277V

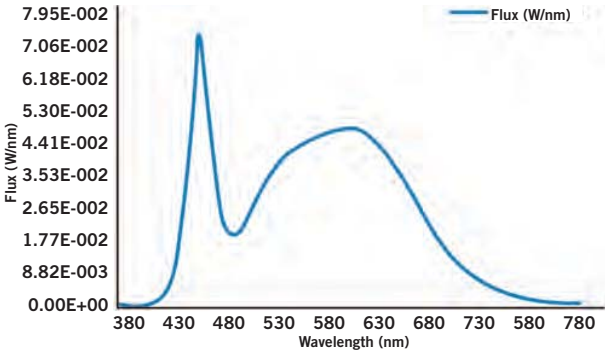
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	4000K
Luminous Flux	1750 lm
Color Rendering Index (CRI)	>80
Efficacy	135 lm/W
Beam Angle	240º
Visible Light Area	325º

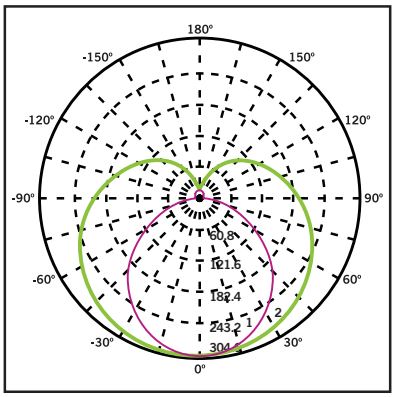
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

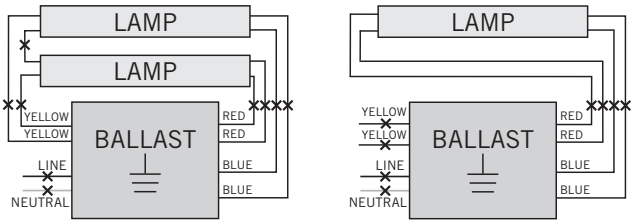
SINCE 1945 KEYSTONE | DIRECTDRIVE LED
LINE VOLTAGE T5 TUBES

KT-LED13T5HE-48GC-840-D
T5 LED LAMP

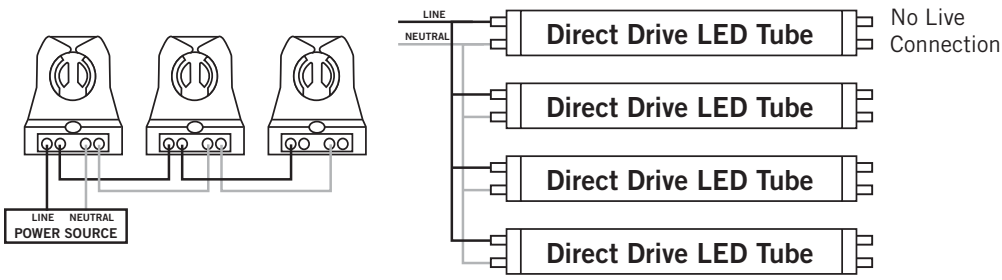
WIRING DIAGRAMS

1. Cut all existing connections to ballast as shown below and remove ballast.

Typical Ballast Configurations:



2. Re-wire fixture as shown below.



Typical Non-Shunted Lampholder



Connect wires directly to these terminals

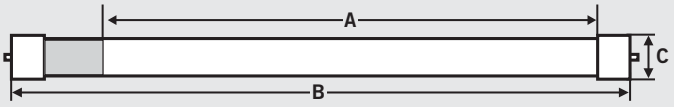
CAUTION: Use only non-shunted lampholders.

Do not install product in a fixture with shunted lampholders (found in all fixtures using instant start ballasts). If the current lampholders are shunted, remove them and replace them with non-shunted lampholders. Make new connections directly to terminals as indicated above.

Keystone can provide any style replacement lampholders. Call us at 800-464-2680.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	41.38”
B (Body Length)	45.19”
C (Diameter)*	0.82”

NOMINAL LENGTH: 48” **BASE TYPE:** G5 (Miniature Bi-Pin)

*Though nominally referred to as a T5, this lamp has a T6 diameter

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED13T5HE-48GC-840-D-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED13T5HE-48GC-840-D-CP

- KT — Keystone Technologies
- LED — LED Lamp
- 13 — Wattage
- T5HE — Lamp Type
- 48 — Nominal Length (Inches)
- GC — Shatter-Proof Coated Glass
- 840 — 800 Series
- D — Color Temp.
- CP — Direct Drive Series
- Packaging Style

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

T5 WIRING HARNESS
RETROFIT ACCESSORIES



G5KIT1



G5KIT4



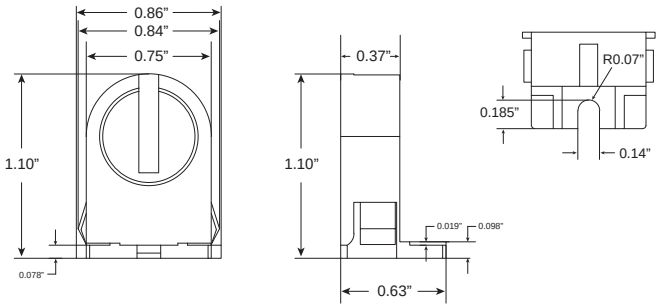
G5KIT6

PRODUCT DESCRIPTION:

MaxLite T5 wiring harness is the ideal solution for retrofiting fluorescent T5 lamps with Type-B LED T5. Each kit comes with pre-wired non-shunted G5 lampholders and a power quick connector to help reduce installation time and cost.

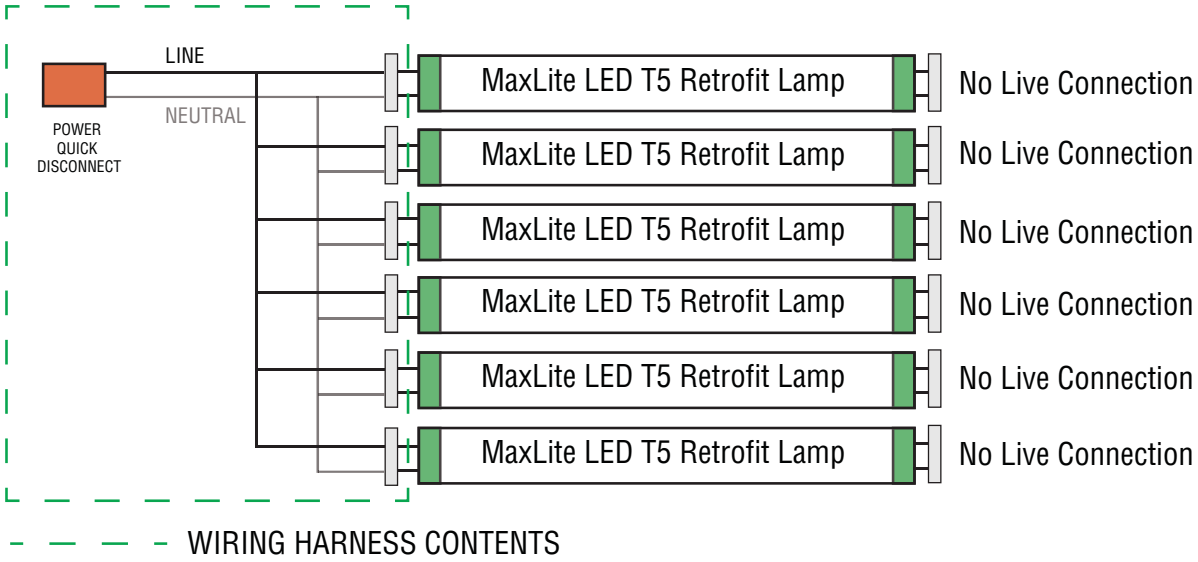
FEATURES:

- Non-shunted G5 lamp holders pre-wired for fast and easy installation
- Easily connect to AC power with quick connector
- UL recognized components
- Rotary lock
- Available in 1-lamp, 2-lamp, 4-lamp and 6-lamp configurations



ORDER CODE	ITEM NUMBER	DESCRIPTION
14098784	G5KIT1	1-Lamp Wiring Harness for LED T5 Single-End Powered, Ballast Bypass Lamps
14098785	G5KIT2	2-Lamp Wiring Harness for LED T5 Single-End Powered, Ballast Bypass Lamps
14098786	G5KIT4	4-Lamp Wiring Harness for LED T5 Single-End Powered, Ballast Bypass Lamps
14098787	G5KIT6	6-Lamp Wiring Harness for LED T5 Single-End Powered, Ballast Bypass Lamps

WIRING DIAGRAMS:



SnackMiser™

ENERGY MANAGEMENT SYSTEM
For Snack Vending Machines

The power behind the profits...

SnackMiser™ puts the power of savings into your environment.

With SnackMiser, your current snack venders can achieve maximum energy savings resulting in a reduction in both operating costs and greenhouse gas emissions. Compatible with non-refrigerated snack vending machines, SnackMiser incorporates innovative, energy-saving technology into a small, plug-and-play unit that installs in minutes.

A Practical approach to power

SnackMiser uses a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, SnackMiser will sense the presence and power up immediately. In addition to reducing energy costs, this practical power play lengthens the expected lifetime of your machine and reduces its exposure to power line spikes.

On average, SnackMiser reduces energy consumption annually per machine by $50 and CO2 emissions by 470 lbs. and 770 grams of NOx, based on occupancy and the Energy Information Administration's national average of greenhouse gas emissions and electricity generation.

This Miser runs the bank

For a bank of machines, SnackMiser can use its embedded Sensor Repeater, which allows it to be controlled from the PIR sensor of any other Miser in the bank. SnackMiser can stand alone or be an ideal partner for VendingMiser®.



SnackMiser offers...

- A quick, inexpensive solution to energy savings and conservation
- Longer machine lifespan
- Environmental benefits
- Early return on investment

SnackMiser Technical Specifications

Electrical Specifications
Input Voltage: 115 Volts
Input Frequency: 50/60 Hz
Maximum Load: 1050 Watts (Steady-State)
Power Consumption: Less than 1 Watt (Standby)

Environmental Specifications
Operating Temp: 0°C to 50°C
Storage Temp: -20°C to 60°C
Relative Humidity: 95% Maximum (Non-Condensing)

Compatibility
Snack Vending Machines: Any type, as long as SnackMiser's maximum power rating is not exceeded

Inactivity Timeouts
Occupancy Timeout: 15 minutes

Dimensions
Size: 4.5"W x 1.75"H x 3.25"D
Weight: 2 lbs. (includes power cable)

Regulatory Approvals
Safety: UL/C-UL Listed
Information Technology Equipment (ITE) 9T79

Other energy-saving products offered by USA Technologies include VendingMiser®, VM2IQ™, CoolerMiser™ and PlugMiser™.

GSA Schedule Contract GS-35F-0031R

ENERGY STAR PARTNER

USA TECHNOLOGIES

Frequently Asked Questions

How Does SnackMiser™ Work?
SnackMiser™ uses a PIR sensor to determine if there is anyone within 25 feet of the machine. SnackMiser™ waits for 15 minutes of vacancy and then powers off the snack machine. If a customer approaches the snack machine while powered down, SnackMiser™ will sense the person's presence and power up immediately.

Will SnackMiser™ affect the lifetime of the lights in my machine?
The replacement frequency of the fluorescent lamps will be reduced. While it is true that power cycling fluorescent lamps will shorten their life, the hours that the machine is powered down greatly exceeds this reduction in burn hours. The net effect is that the lamps will need replacement less often.

Are there any locations not appropriate for SnackMiser™?
A machine in a location that is occupied 24-hours, 7 days a week will likely generate little savings.

Is the SnackMiser™ easy to install?
Yes. The SnackMiser™ can be installed on the wall with the supplied bracket holder or it can be attached to the snack machine using the new Easy-Install system. Because many SnackMisers™ are installed with a VendingMiser®, sensor installation might not even be needed.

Technical Specifications

ELECTRICAL SPECIFICATIONS

Input Voltage:	115 Volts (230 Volts available)
Input Frequency:	50/60 Hz
Maximum Load:	1050 Watts (Steady-State)
Power Consumption:	Less than 1 Watt (Standby)

ENVIRONMENTAL SPECIFICATIONS

Operating Temp:	0°C to 50°C
Storage Temp:	-20°C to 60°C
Relative Humidity:	80% Maximum (Non-Condensing)

COMPATIBILITY

Snack Machines:	Any type, as long as SnackMiser's maximum power rating is not exceeded

INACTIVITY TIMEOUTS

Timeout Period:	15 minutes

DIMENSIONS

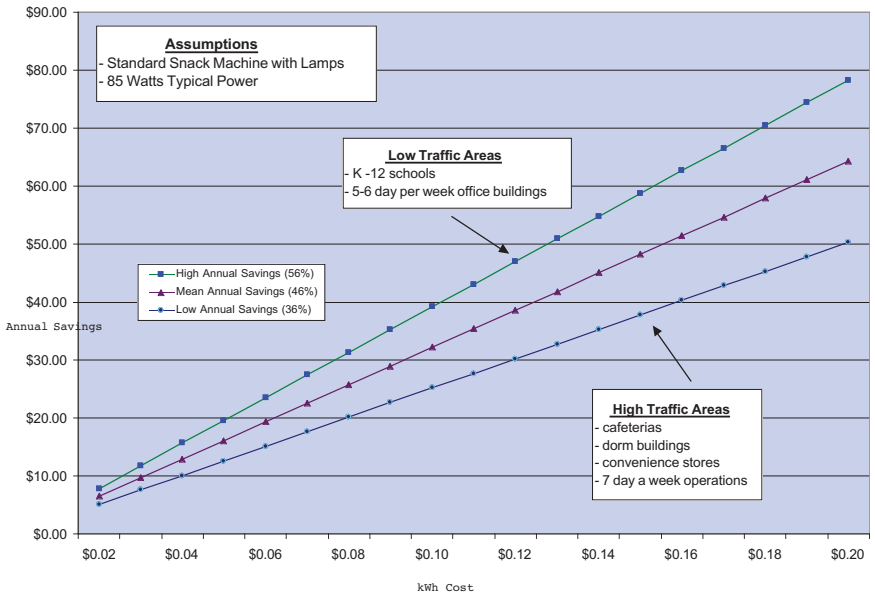
Size:	4.5"W x 1.75"H x 3.25"D
Weight:	2 lb. (incl. power cable)

REGULATORY APPROVALS

Safety:	UL/C-UL Listed Information Technology Equipment (ITE) 9T79

UL LISTED c UL LISTED

Typical Saving Generated with SnackMiser™



SnackMiser™ Products

SM150	SnackMiser with PIR Sensor
SM151	SnackMiser only
SM170	Easy-Install SnackMiser with PIR Sensor
SM171	Easy-Install SnackMiser only

For more information about SnackMiser by USA Technologies
888.521.6982 • www.usatech.com

VendingMiser®

ENERGY MANAGEMENT SYSTEM
For Refrigerated Vending Machines

Improve the profitability of your existing cold drink machines. Vending Miser® puts you on a cost-effective refresher course for energy savings and conservation.



VendingMiser cuts energy costs down to size

VendingMiser incorporates its innovative energy-saving technology into a small, plug-and-play powerhouse that installs in minutes either on the wall or on the vending machine. It's that easy.

With VendingMiser there's no need to have new machines to achieve maximum energy savings resulting in a reduction in operating costs and greenhouse gas emissions. When equipped with the VendingMiser, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR® qualified machines.

Power play

Compatible with all types of cold drink vending machines, the VendingMiser uses a Passive Infrared Sensor (PIR) to power down the machine when the area surrounding it is vacant. Then it monitors the room's temperature and automatically re-powers the cooling system at one- to three-hour intervals, independent of sales, to ensure that the product stays cold.

This Miser runs the bank

For a series of up to four machines, VendingMiser can use its embedded Sensor Repeater, which allows it to be controlled from the PIR sensor of any other Miser in the bank.

Refresher course

VendingMiser's microcontroller will never power down the machine while the compressor is running, eliminating compressor short-cycling. In addition, when the machine is powered up, the cooling cycle is allowed to finish before again powering down. This reduces the wear and tear on your machines, extending the lifespan and prolonging your profitability. Maintenance savings is generated through reduced running time of vendor components – estimated at $40 - $80 per year, per machine. The VendingMiser has been tested and accepted for use by major bottlers.

VendingMiser reduces energy consumption an average of 46%—typically $150 per machine.

Vending Miser offers...

- A quick, inexpensive solution to energy savings and conservation
- Longer machine lifespan
- Early return on investment
- Environmental benefits

VendingMiser can also control other cooled product vending machines, such as refrigerated candy machines.

VendingMiser Technical Specifications

Electrical Specifications
Input Voltage: 115 Volts
Input Frequency: 50/60 Hz
Maximum Load: 12 Amps (Steady-State)
Power Consumption: Less than 1 Watt (Standby)

Environmental Specifications
Operating Temp: -15°C to 75°C
Storage Temp: -40°C to 85°C
Relative Humidity: 95% Maximum (Non-Condensing)

Compatibility
Vending Machines: Any machine, except those containing perishable goods such as dairy products

Inactivity Timeouts
Occupancy Timeout: 15 minutes
Auto Re-power: One to three hours, dynamically adjusted, based on ambient temperature

Dimensions
Size: 4.5"W x 1.75"H x 3.25"D
Weight: 2.2 lbs. (includes power cable)

Regulatory Approvals
Safety: UL/C-UL Listed
Information Technology Equipment (ITE) 9T79

Other energy-saving products offered by USA Technologies include VM2IQ™, CoolerMiser™, SnackMiser™ and PlugMiser™.

GSA Schedule Contract GS-35F-0031R

ENERGY STAR PARTNER

USA TECHNOLOGIES

Frequently Asked Questions

Will VendingMiser® keep my drinks cold?
Absolutely - VendingMiser® has been tested and accepted for use by both major bottlers.

Is the VendingMiser® easy to install?
Yes! VendingMiser® is a simple external plug-and-play product. The VendingMiser® can be installed on the wall with simple hand tools or it can be attached to the vending machine without tools using the new Easy-Install system. The Easy-Install System allows quick installation in 5 minutes.

Is VendingMiser® safe for all machines?
Yes! VendingMiser® is compatible with all types of cold drink vending machines. In fact, by reducing run time of the machines, VendingMiser® reduces maintenance costs.

Has VendingMiser® been field tested?
Tens of thousands of VendingMisers® are operational in the field. Typical energy savings have been independently documented to be between 35% and 45%. Measurement and verification test results as well as testimonials are available on the website.

Are there any locations not appropriate for VendingMiser®?
VendingMiser's® savings are generated as a result of location vacancy. Therefore, a machine in a location that is occupied 24-hours, 7 days a week will likely generate little savings. Our VM2IQ is more appropriate for this type of location and will typically save up to 35% energy use.

Technical Specifications

ELECTRICAL SPECIFICATIONS

Input Voltage:	115 Volts (230 Volts available)
Input Frequency:	50/60 Hz
Maximum Load:	12 Amps (Steady-State)
Power Consumption:	Less than 1 Watt (Standby)

ENVIRONMENTAL SPECIFICATIONS

Operating Temp:	-15°C to 75°C
Storage Temp:	-40°C to 85°C
Relative Humidity:	95% Maximum (Non-Condensing)

COMPATIBILITY

Vending Machines:	Any machine, except those containing perishable goods such as dairy products.

INACTIVITY TIMEOUTS

Occupancy Timeout:	15 minutes
Auto Repower:	One to three hours, dynamically adjusted, based on ambient temperature

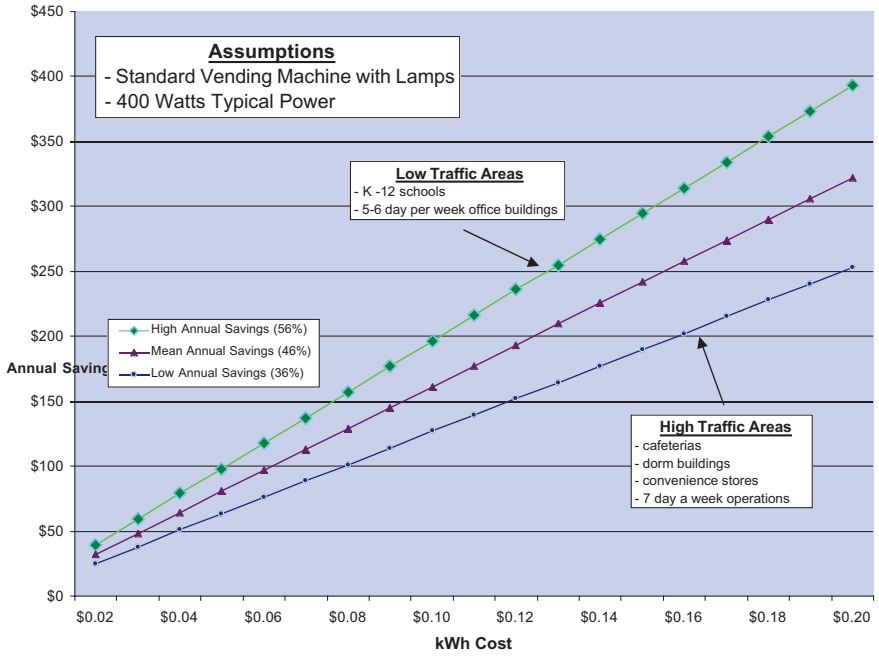
DIMENSIONS

Size:	4.5"W x 1.75"H x 3.25"D
Weight:	2.2 lb. (incl. power cable)

REGULATORY APPROVALS

Safety:	UL/C-UL Listed Information Technology Equipment (ITE) 9T79

Typical Saving Generated with VendingMiser®



VendingMiser® Products

VM150	VendingMiser® with PIR Sensor
VM151	VendingMiser® only
VM160	Weatherproof VendingMiser® with PIR Sensor
VM161	Weatherproof VendingMiser® only
VM170	Easy-Install VendingMiser® with PIR Sensor
VM171	Easy-Install VendingMiser® only
VM180	Weatherproof Easy-Install VendingMiser w/PIR sensor
VM181	Weatherproof Easy-Install VendingMiser only

MOMENTIVE™

Technical Data Sheet

Enduris* 3500

silicone roof coating

Product Description

GE Enduris 3500 silicone roof coating is a high performing protective barrier for a variety of architectural surfaces and roofing substrates. Upon cure, Enduris 3500 silicone roof coating forms a durable, breathable and weatherproof roofing membrane that is highly resistant to degradation from UV and natural weathering.

Key Features and Typical Benefits

- **Silicone Durability** – Cured silicone rubber exhibits excellent long-term resistance to natural weathering including: extreme temperatures, ultraviolet radiation, rain and snow.
- **VOC Compliant** – High solids solvent-free formulation and low Volatile Organic Compounds content is well below the current limits of California's relevant Air Quality Management Districts.
- **Ease of Use** – Can be applied with common airless equipment, roller or brush.
- **Versatile Application** – Enduris 3500 silicone roof coating is a single component material that requires no mixing of separate components and can be applied by spray, roller or brush.
- **High Build Formulation** – Allows for single coat application and hangs on peaks without sagging.
- **Storage & Shelf Life** – Enduris 3500 silicone roof coating can be stored in unheated warehouses during the cooler months without the risk of freezing. Shelf life is 18 months from date of manufacture when properly stored

Potential Applications

For structurally sound roofing applications including over existing coatings, single ply, modified bitumen and BUR, foam, metal and other horizontal and vertical roofing. Perform an adhesion test on each surface type to ensure adhesion.

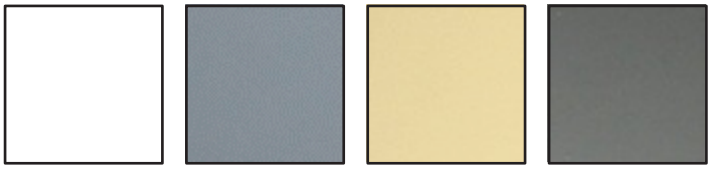
GE is a registered trademark of General Electric Company and is under license by Momentive Performance Materials Inc.
*Enduris is a trademark of Momentive Performance Materials Inc.

Licensed
Products

Packaging and Colors

Enduris 3500 silicone roof coating is available in nominal 5 gallon plastic pails and 55 gallon chimed steel drums. Weights shown below approximately correlate to 50 gallons and 5 gallons per container.

Grade	Color	Container	Weight (Lbs.)	Weight (Kg)
SCM3502	White	Steel drum	540.0	245.2
SCM3502	White	Plastic pail	54.0	24.5
SCM3504	Medium Grey	Steel drum	540.0	245.2
SCM3504	Medium Grey	Plastic pail	54.0	24.5
SCM3505	Tan	Steel drum	540.0	245.2
SCM3505	Tan	Plastic pail	54.0	24.5
SCM3508	Dark Grey	Steel drum	540.0	245.2
SCM3508	Dark Grey	Plastic pail	54.0	24.5



White Enduris 3502 | Medium Grey Enduris 3504 | Tan Enduris 3505 | Dark Grey Enduris 3508

General Considerations for Installation

Refer to Design and Application Guide for surface preparation requirements, design information and detailed application instructions.

Physical Properties

Typical physical property values of Enduris 3500 UltraGlaze structural glazing silicone adhesive as supplied and cured are set forth in the tables below:

Typical Physical Properties – Supplied

Property		Value(1)	Test Method
Solids Content,	Volume	90	
	Weight	91	ASTM D1644-01 Modified
Tack Free Time		20-30 minutes	ASTM D3960
Skin-Over Time		10-15 minutes	WPSTM C-560
Viscosity		22,000 centipoises	ASTM D2196
Tensile Strength		204 psi (1.41 MPa)	ASTM D2370
Elongation		542%	ASTM D2370
Durometer Hardness Shore A		36	ASTM D2240
TVOC		<24 g/L	EPA Method 24
Solar Reflectance(2)		88%	ASTM C1549
Emittance(2)		0.90	ASTM C1371
SRI Value(2)		111	ASTM E1980
Permeance		9.3 perms	ASTM E96 (BW)
Tear Resistance		32 lbf/in.	ASTM D624
Low Temperature Flexibility		Pass	ASTM D522 (B)
Resistance to Wind Driven Rain		Pass	TT-C-555B

(1) Typical data are average data and are not to be used as or to develop product specifications.
(2) Values derived from testing of SCM3502 (white), weathering test in progress.

Applicable Standards

- ASTM D6694 – Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing Systems.
  Result: Pass
- **Cool Roof Rating Council (CRRC)** – Licensed Seller ID 1200. SCM3502 (white) only. Rated Product ID – 0002.
- **UL 790** – Flammability Characteristics – SCM3500 silicone roof coating carries Class "A" Non-Combustible and Class "B" Combustible credentials as tested under UL 790 procedures over spray foam and single ply roofing systems. Refer to the UL directory for specific information.
- **ASTM E84** – Standard Test Method for Surface Burning Characteristics of Building Materials. Result: Class A (Flame Spread Index 10, Smoke Developed Index 185).
- **Miami Dade NOA** – 13-1119.01
- **CAL FIRE**
- **California Title 24 Compliant** - Can be used to comply with Title 24 high efficacy requirements.
- **FM Global**
- **Energy Star**

Technical Services

For additional technical resources, please contact your local customer service center. (See Customer Service Centers section herein for contact information.) Any technical advice furnished by MPM or any representative of MPM concerning any use or application of any MPM product is believed to be reliable, but MPM makes no warranty, expressed or implied, of suitability for use in any application for which such advice is furnished.

Customer Evaluation

Customers must evaluate MPM products and make their own determination as to the fitness of use in their particular applications.

Patent Status

Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

Product Safety, Handling and Storage

Customers considering the use of this product should review the latest Safety Data Sheet and label for product safety information, handling instructions, personal MPM representative. Use of other materials in conjunction with MPM sealant products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials

*Enduris is a trademark of Momentive Performance Materials Inc.

Uncured Product Storage

Enduris 3500 silicone roof coating should be stored in sealed containers in a dry area, out of direct sunlight and high heat. Do not open containers until ready for use and store containers at or below 109°F (43°C) to maintain full shelf life. Enduris 3500 silicone roof coating generally can be stored in unheated warehouses during the cooler months without the risk of freezing.

Enduris 3500 silicone roof coating reacts with atmospheric moisture to cure. Once containers are open and exposed to the atmosphere, a skin will form on the material over time. The formation of skin will be negligible in winter months but can form quickly (minutes) under hot and humid conditions. Cured skin that has formed on the top of the material must be removed or screened from the bulk material, as it may contribute to pump clogging. Take appropriate precautions to cover open containers during use.

Installation Considerations

Surface Preparation

Enduris 3500 silicone roof coating can be applied to itself as well as a variety of roofing materials and substrates including: single ply membranes (TPO, PVC, EPDM, CSPE, and Hypalon), spray-applied polyurethane foam, metal, concrete, and common parapet/coping materials. Asphaltic substrates such as; modified bitumen, smooth BUR, and granulated cap sheet which may require bleed blocker. Surfaces to which Enduris 3500 silicone roof coating is to be applied must be clean, dry, structurally sound and free of loose particles, dirt, dust, oil, frost, mildew and other contaminants. Damage to the underlying roof system, such as cracks, openings, holes, etc. should be properly repaired prior to application. Saturated substrates must be removed and repaired appropriately. Users of Enduris 3500 silicone roof coating should verify that suitable adhesion can be attained to all existing roofing materials to be coated prior to large scale application of the coating. It is recommended that a test patch be cleaned and coated with Enduris 3500 silicone roof coating to verify the effectiveness of the asphalt bleed cleaning method and adhesion to the surface(s).

Application Guidelines

Enduris 3500 silicone roof coating should be applied as received and dilution with solvent is not recommended. If settling in the package has occurred, stir or shake the material prior to use. Care should be taken to avoid overspray onto adjacent building materials, vehicles, plants, etc. Overspray can be cleaned up before it has cured by wiping alternately with solvent and dry rags. Cured material can be removed from surfaces with a razor blade, or scrubbed off with steel wool or synthetic abrasive pads and solvent. To control overspray, avoid spraying in winds that may cause drift. Surfaces not intended for coating should be masked or covered.

Enduris 3500 silicone roof coating should be sprayed or rolled ensuring uniform build and thorough coverage and is typically applied in one coat. If applying in multiple coats, allow adequate time between each coat for the coating to cure before applying additional coat. Final cured film thicknesses must be free of voids, pinholes, cracks or blisters.

Application Temperature

Enduris 3500 silicone roof coating can be applied throughout the year as long as the substrates being coated are completely dry. Frost and/or moisture will interfere with adhesion. Lower temperatures will lengthen the skin over, tack free and ultimate cure time and may require an overnight cure in winter months to allow the top coat application to proceed (film build may not be sufficient to allow walk over). Higher temperatures will accelerate the cure rate and decrease the open time of the coating. Contact manufacturer if applying to substrates over 120°F (49°C).

Application Equipment

Enduris 3500 silicone roof coating can be applied by spraying, rolling or brushing. Enduris 3500 silicone roof coating works with most commercially available spray application equipment that can deliver a minimum of 3,300 psi at the spray tip for at least 2.2 gallons per minute. Always use components rated for the required pump pressure. Hoses should be vapor lock type for prevention of moisture contamination. Contact MPM technical services for equipment recommendations.

Cleanup of spray equipment containing uncured material may be accomplished by flushing with mineral spirits or toluene. DO NOT USE water or alcohol based solvents. Enduris 3500 silicone roof coating cures by reacting with moisture, thus it should not be left in pumping equipment and hoses for prolonged periods unless equipment contains moisture lock hoses, fittings and seals. Equipment without moisture lock hoses, fittings and seals may transmit sufficient moisture vapor to gradually form cured material on hose walls and at unsealed connections. This can cause increased operating pressures and flow restriction.

Application

Coating Vertical Surfaces

When coating vertical wall surfaces, other than parapets and walls associated with the roofing system, GE SEC2400 SilShield* silicone architectural coating is suggested. Contact an MPM representative for additional information.

*Enduris and SilShield are trademarks of Momentive Performance Materials Inc.

Limitations

Enduris 3500 silicone roof coating should not be considered for:

- Use on pedestrian, deck or frequent traffic bearing surfaces.
- Cold storage roofing application without vapor barrier, cryogenic tank applications, or continuous water immersion service.
- Unprepared surfaces including but not limited to those that are wet, dusty, oily, mildewed, heavily chalked, blistered or otherwise structurally unsound.
- Building materials that might bleed oil or solvents. These include, but are not limited to, certain vulcanized rubber products, tapes, failed sealants, some caulking compounds and asphaltic/mastic materials unless appropriate preparation or primers are used. Consult Momentive Performance Materials (MPM) technical services for primer recommendations.
- Surfaces where adhesion has not been verified by testing.
- Inclement weather may negatively affect uncured Enduris 3500 silicone roof coating by displacement of uncured material; therefore, application of coating should not proceed if heavy rain, hail or snowfall is impending or expected within 24 hours of application.
- Enduris 3500 silicone roof coating requires atmospheric moisture for propagation of cure thus it is not suitable for use in totally confined spaces.

Emergency Service

Momentive Performance Materials maintains an around-the-clock emergency service for its products. The American Chemistry Council (CHEMTREC), Transport Canada (CANUTEC), and the Chemical Emergency Agency Service also maintain an around-the-clock emergency service for all chemical products.

Location	GE Branded Products	All Chemical Products
U.S., Puerto Rico, Canada, Latin America	1.518.233.2500	CHEMTREC: 1.800.424.9300 CA: CANUTEC: 1.613.996.6666 (collect)
At sea	Radio U.S. Coast Guard, which can directly contact Momentive Performance Materials at 1.518.233.2500	CHEMTREC: 1.800.424.9300

DO NOT WAIT. Phone if in doubt. You will be referred to a specialist for advice.

CUSTOMER SERVICE CENTERS

Americas	1.800.295.2392 1.614.986.2495 **Email:** commercial.services@momentive.com

Visit us at www.ge.com/silicones

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TDS-END3500-EN (2/16)



GE Enduris*
Silicone Roof Coating

Add Decades to Roof Life in Days

Roofs have it hard. On an 89° day, a typical black roof can experience a 100° variation from 175° at the hottest peak to 75° ambient temperature at night. This constant temperature fluctuation and UV exposure can create tremendous strain over time. Most commonly, roofs fail where dissimilar materials meet at penetrations, seams and edges. Minor structural issues can cause additional challenges such as poor drainage and ponding water.

For over 50 years, professionals have trusted GE to deliver durable, long-lasting building solutions. The GE Enduris* roof coating system is a fast, efficient and economical alternative to replacement. Based on GE-heritage technology, the GE Enduris system is backed by world-class technical support and a 10-, 15- or 20-year warranty.

Restore with Silicone

A seamless, stable and energy-efficient coating can dramatically extend roof life expectancy, delaying the need for a costly, time-consuming replacement project.

Silicone is inherently durable and permanently flexible. Unlike acrylic, polyolefin, asphaltic and carbon-based polymer chains, silicone is completely UV stable, providing the maximum long-term performance against weather and atmospheric conditions. The entire GE roof coating system is made from the same 100% silicone, allowing it to expand and contract at the same rate, helping prevent leaks that may result in mold, mildew, wood rot and rust. A white silicone coating also reflects the sun's rays to better control inside temperatures.

Restore with Confidence

Silicone remains stable, flexible and virtually unaffected by daily and seasonal temperature extremes. It will not become brittle or harden as the system ages. The GE Enduris system provides exceptional, long-term performance.

- **Ponding water**
  While acrylic coatings tend to fail at the seams, penetrations and edges, especially where water ponds, Enduris coatings stand up to ponding water.
- **Life cycle cost**
  Primerless, single-coat application brings efficiency and cost savings to the installation process. Long-term durability promotes a lower total life cycle cost.
- **Energy savings**
  Energy savings versus a black roof can be as great as 35% on summer cooling costs. GE Enduris coatings offer excellent color retention and reflectivity with a silicone polymer that is UV stable.
- **Full compatibility**
  Using only 100% silicone components that are chemically and adhesively compatible, Enduris helps prevent water leakage, mold/mildew, wood rot and metal rust.
- **Best-in-class elongation**
  By remaining flexible with daily and seasonal temperatures throughout the life of the building, this system offers best-in-class elongation, both initially and after decades of exposure.





RESTORE VIRTUALLY ANY EXISTING ROOF TYPE

GE Enduris restoration systems are appropriate over most structurally sound existing roofing systems including:

- Single-ply membranes (TPO, EPDM, PVC)
- Asphaltic and mod bit
- Metal
- Concrete
- Foam

Contact us for application to additional substrates

*Enduris is a trademark of Momentive Performance Materials Inc.

GE Enduris* Three-Component System



GE Enduris Roof Coating

High-solids, low-VOC, 100% silicone liquid coating applied in a single coat. While a primer is not required, an asphalt bleed-blocking base coat can promote energy savings, and an EPDM wash can help optimize adhesion. Currently available in totes, drums and pails and in standard colors white, tan, medium gray and dark gray. Custom colors may be requested.

GE RF100 Reinforcing Fabric

This flexible, easy-to-use reinforcing fabric embedded between layers of sealant or coating is acceptable for sealing virtually all seams, curbs and penetrations. Currently available in 4", 6" and 12" widths in 100' rolls. Larger sizes may be available.





GE Enduris Seam Sealant

Low-VOC 100% silicone, single-component liquid sealant for joints, seams, gaps and splices, offering long-term performance in sealing out water and withstanding weather and atmospheric conditions without degradation. Currently available in 2-gallon pails.



*Enduris is a trademark of Momentive Performance Materials Inc.

Benefit Now and Later

Time and labor savings

With no primer required on coated and uncoated roofing membranes, this system can offer significant cost savings associated with labor, primer and time delays.

Full compatibility

Can be applied to most existing roof types including asphaltics (BUR and Mod Bit), single-ply (TPO, PVC, EPDM), SPF foam, concrete and metal.

Cold weather application

GE Enduris* 3500 coating can be rolled or sprayed in temperatures as low as 0° F without freezing, helping to extend the roofing season and avoid project delays.

We Stay on Top of It All

In addition to a proven roofing system from a trusted leader, the coatings team offers technical assistance from a project's inception to completion. With decades of experience on some of the world's most innovative structures, the team provides a wealth of knowledge and support to help deliver results including:

1. **Project Review** – Review of project details to assist with product selection and application based on usage criteria, specifications and customer needs.
2. **Drawing Details** – Assist in developing drawing details that address project-specific terminations, transitions and penetrations.
3. **Project Testing** – On-site testing for substrate adhesion or compatibility with other building materials if necessary.
4. **Project Warranty**† – Extended warranties are offered for long-term assurance.

SIMPLICITY AND INTEGRITY FROM A TRUSTED BRAND

With over five decades of superior product performance, the GE Enduris 100% silicone roof coating system can bring confidence and compliance to roof restorations and repairs. Simplified installation promotes safety and improves efficiency, helping to ensure that the job is done right every time. To learn more about GE-branded coatings, visit **www.ge.com/silicones** or contact your local distributor today.

Made in the USA

To order, call Momentive Customer Service toll-free at **866-275-4372**.
Fax orders to Customer Service at **614-986-2489**.
For additional information visit **www.ge.com/silicones**.

MOMENTIVE™

CRRC RATED PRODUCT

CLASSIFIED UL

FM APPROVED

Title 24 Compliant

MIAMI-DADE COUNTY APPROVED

Licensed Products

†Inspection of the completed project by a third-party engineering firm is required for warranty validation. See individual product labels for additional information, including specific warranty terms, product application conditions and/or other use requirements or specifications with respect to our claims.

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Your Roofing Solution

Spray Polyurethane Foam Roofing
From Covestro

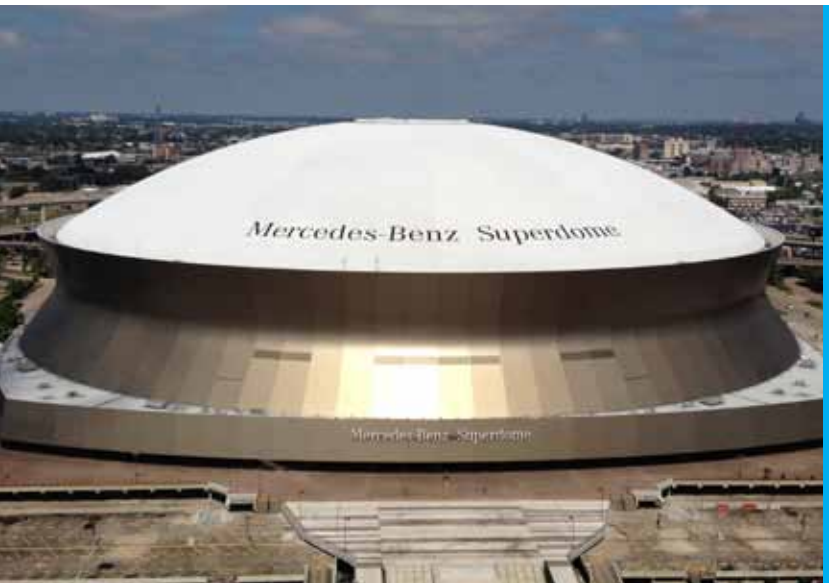
covestro



Roofing Performance

Occupants don't give them a second thought yet they keep facility managers awake at night. Roofing is one of the most challenging parts of the building envelope. They work hard keeping water out and conditioned air in, and they bear the load of all the facility equipment the roof usually supports. Installation, operations, maintenance and energy efficiency are constant concerns, yet can be addressed with the right product.

Spray polyurethane foam (SPF) roofing from Covestro provides the performance and efficiency today's facilities require. Covestro's SPF roofing offers intelligent solutions for energy-efficient construction in every climate zone. Insulation materials made of polyurethane help to effectively insulate roofs, walls and floors. When the six sides of a building work together as one complete whole, the building envelope performs more efficiently.



Covestro SPF roofing systems have been tested and received rating classifications from:

- Underwriters Laboratories (UL)
- Factory Mutual
- Energy Star
- Miami-Dade County
- ICC Evaluation Service
- Cool Roof Rating Council



From Start to Finish

SPF Roofing from Covestro is a Cost-Effective, Long-Term Facility Solution



INSTALLATION

- SPF roofing can be applied over the existing roof, so tear off may be unnecessary; save time and divert waste from landfills.
- The adhesive nature of SPF eliminates metal fasteners used to secure the product to the deck, so no roof penetrations are made.
- SPF is self-flashing; metal counter flashing is not required.
- SPF is easily sprayed around piping or other roof penetrations.



OPERATIONS & MAINTENANCE

- SPF helps minimize the migration of moisture through the roof.
- Rooftop modifications can be made easily. New SPF applications are applied over existing foam.
- The insulating and air sealing properties of SPF reduce temperature fluctuations on roof components and helps extend the life of the roof.
- Limited warranties may be available for SPF projects completed by Covestro silver and gold accredited contractors.



[Snow on single ply roof melting where thermal bridging occurs.]

ENERGY EFFICIENCY

- The monolithic nature of SPF minimizes air gaps, as with insulation boards.
- The high insulation value of SPF reduces the energy absorbed by the roof system and may reduce the heat island effect.
- The elimination of metal fasteners also eliminates thermal bridging (heat transfer).
- The SPF Life Cycle Assessment (LCA) shows the energy saved with SPF over the building's life exceeds the embodied energy spent during material processing, transportation, and installation.

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Savings vary. Find out why in the seller's fact sheet on R-values. Higher R-values mean greater insulating power. Stated savings are estimates only. Actual savings may vary depending on type of home, weather conditions, occupant lifestyle, energy prices and other factors. No specific guaranty or warranty of energy or costs savings is being given and all such guaranties or warranties are expressly disclaimed.

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COVROOF 9/15

DAIKIN

Catalog 256-12

Rebel™
Commercial Packaged Rooftop Systems

Heating & Cooling
Models DPS 003 – 028
3 to 28 Tons
R-410A Refrigerant
Energy Recovery Wheel



3–6 tons

7–15 tons
Shown with Energy Recovery

16–28 tons
Shown with Energy Recovery

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Rebel, the most energy efficient packaged rooftop unit

Daikin Rebel™ commercial rooftop systems provide building owners with energy savings of up to 84% above ASHRAE's 90.1 standard, enabling for complete system payback in under two years. Combining quality manufactured Daikin equipment with advanced Daikin technologies, Rebel delivers a superior commercial rooftop part-load rating of up to 20.6 IEER, making these units ideal for any low-rise commercial building like schools, retail, medical offices, and dedicated outdoor air systems.

Rebel's innovative design utilizes an industry first variable speed Daikin heat pump with hybrid heat (gas, electric, or hot water) options, variable speed ECM motors on all fans, ultra-quiet composite condenser fans, and an advanced modulating variable speed inverter scroll compressor to achieve unprecedented rooftop energy efficiencies.

Configurable as an industry-first VAV heat pump, Rebel offers further configuration flexibility for adverse weather conditions. For much of winter, Rebel's heat pump provides a more economical solution than gas heat. During extreme cold weather, back-up hybrid heat options can be used for additional heat and defrost operation.

Variable speed ECM motors or VFDs on all fans greatly increase system reliability and efficiency by eliminating use of belts. These motors incorporate built-in inverters and ultra-efficient magnetic rotors to save energy at light load conditions.

Composite Daikin condenser fans create ultra-quiet operation, are UV and corrosion resistant, and deliver tremendous energy savings via ECM motors.

Rebel's variable speed Daikin inverter scroll compressor delivers higher energy efficiency ratios and lower energy costs than typical fixed speed, digital scroll, or 2-stage scroll compressors. The Daikin inverter scroll compressor provides true modulating capacity and unsurpassed comfort control by continuously monitoring and adjusting that temperature. Because the inverter operates and adjusts room temperature only when needed, energy consumption (and noise) drops drastically compared to traditional on/off compressor systems.

Modulating hot gas reheat, electronic expansion valves, economizer, MicroTech® III controls, 100% OA, and more, further contribute to superior efficiencies, enhanced comfort, quiet operation, quality, reliability, and serviceability you expect from the world's leading HVAC manufacturer.

An optional energy recovery wheel transfers both heat and moisture energy between the exhaust and ventilation air. In doing so, it conditions the incoming ventilation air. This total energy device offers a cost-effective and efficient method for containing energy costs while meeting ventilation requirements of ASHRAE Standard 62.1.

Award-winning performance

Since introduction, Rebel's use of those advanced technologies have led numerous system performance awards, such as:

- 2014 Consulting Specifying Engineer Product of the Year Finalist
- 2013 ACHR The News Dealer Design Gold Award
- 2013 Buildings Top Money Saving Products
- 2012 Minnesota Business Innovator of the Year
- 2011 ACHR The News Dealer Design Silver Award

Industry Firsts

- 1st to meet/exceed DOE Rooftop Unit Challenge.
- 1st AHRI certified VAV/air-to-air heat pump.
- 1st rooftop/heat pump with variable .speed compressors.
- 1st rooftop/heat pump with electronic expansion valves.

Agency Listed:

Member of BACnet International · Intertek · AHRI CERTIFIED · LONMARK 3.4

Figure 1: Nomenclature

DPS – 010 – A H H G 4

Daikin Packaged System

Nominal capacity
003 = 3 tons
004 = 4 tons
005 = 5 tons
006 = 6 tons
007 = 7.5 tons
010 = 10 tons
012 = 12 tons
015 = 15 tons
016 = 16 tons
018 = 18 tons
020 = 20 tons
025 = 25 tons
028 = 28 tons

Design vintage
A = Vintage 1

Cooling efficiency
H = High (exceeds ASHRAE 90.1)

Unit style
C = Cooling only, fin tube
H = Heat pump (3–15 tons only)
M = Cooling only, micro-channel

Heat medium
Y = None (cooling only)
G = Natural gas heat
E = Electric heat
W = Hot water heat

Line voltage
2 = 208 volt power supply
3 = 230 volt power supply
4 = 460 volt power supply
5 = 575 volt power supply

Rebel™ Packaged Singlezone Heating and Cooling Units—Features and Options



1 Variable speed Daikin inverter compressor

- Modulating capacity allows for optimum comfort control
- Best part-load efficiency in the industry
- Dependable and quiet operation
- Superior discharge air temperature control

2 Variable speed Daikin heat pump

- More economic than gas heat during winter
- Hybrid backup heat options for extreme cold weather and defrost operation
- Modulating capacity delivers the industry's best heat pump control

3 Electronic expansion valves

- Optimum control of superheat
- Protects compressor from liquid refrigerant
- Increases efficiency by safely lowering head pressure

4 MicroTech® III unit controller

- Open Choices™ feature provides interoperability with BACnet®, Daikin D3 and LonWorks® communication options for easy integration with building automation systems
- Unit diagnostics for easy serviceability
- Outdoor air and humidity control logic maintains minimum fresh air intake and optimum humidity levels
- Optionally add the Intelligent Equipment™ control solution, which provides real-time data streams for benchmarking performance, monitoring system operations and implementing remote diagnostics and control

5 Hinged access doors

- ¼–turn latch door provide easy access to system components for maintenance and service

6 Variable speed ECM motors or VFDs on all fans

- Greatly increases system reliability and efficiency eliminates belts and bearing setscrews
- Saves energy at light load
- Built-in inverter eliminates control panel heat

7 Hybrid backup heat options

- Gas furnace with turndowns as high as 10.1
- Electric heat option with SCR for precise temperature control
- Hot water heat

8 Ultra-quiet Daikin condenser fans

- One-piece composite blade design for noiseless operation
- UV and corrosion resistant
- Variable speed ECM motors provide tremendous energy savings at lower ambient

Rebel™ Packaged Singlezone Heating and Cooling Units—Features and Options



9 Double-wall foam cabinet

- No exposed insulation to the air stream
- Better thermal seal than fiberglass

10 Dehumidification Control

- Hot gas used for “free” reheat
- Tight humidity control without over cooling the space
- Modulating hot gas reheat coil

11 Stainless steel, double sloped drain pan

- Prevents corrosion
- Avoids standing water for high IAQ

12 100% outdoor air option

- Low-leak dampers
- Double-wall blades, edge and jam seals
- Modulating 100° temperature rise furnace
- Modulating compressor
- Modulating hot gas reheat

13 Durable construction

- Foam-injected panels with an R-value of 7 (3–15) or 13 (16–28)
- Increased insulation value for increased system efficiency
- Double-wall construction for increased indoor air quality

14 Low radiated noise

- Enclosed compressor
- Quiet outdoor fan
- Exellent acoustics at lower speeds

15 Economizer

- Provides free-cooling when outdoor conditions are suitable
- Provides fresh air to meet local requirements
- Integrated economizer operating with mechanical cooling
- Optional demand control ventilation for increased system efficiency

16 2" and 4" slide-out filter racks

- Easy filter changeouts for quick serviceability
- 2" MERV 8 filters are provided

17 Optional energy wheel

- Meets ASHRAE 90.1-2010 effectiveness requirements
- Factory installed and tested
- Single-point power

AHRI 340/360 Certified

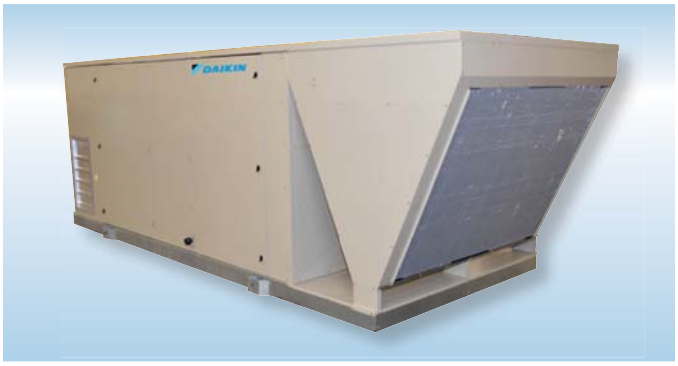
Rebel capacity and efficiency is independently certified by rigorous annual witness testing.

Daikin Rebel rooftop units are built to perform, with features and options that provide for lower installed and operating costs, superior indoor air quality, quiet operation and longevity.

Cabinet, Casing, and Frame

Unit Panel construction includes double-wall with galvanized steel liner to enhance performance and satisfy IAQ requirements.

Figure 2: Durable, Double-wall Construction



- Heavy-duty lifting brackets are strategically placed for balanced cable or chain hook lifting
- Insulated floor panels have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance
- 2 part injected foam insulation have an R-value of 7.0 (3–15 ton) or 13.0 (16–28 ton) for long equipment life and better acoustics
- Panel design includes no exposed insulation edges
- Unit cabinet can operate at total static pressures up to 5.0 inches of water
- Pre-painted galvanized steel exterior surfaces withstand a minimum 750-hour salt spray as per ASTM B117 provides unit for long term durability
- Access doors include multiple, stainless steel hinges and ¼ turn latch system for easy access
- The unit base overhangs the roof curb for positive water runoff and seats on the roof curb gasket to provide a positive, weather tight seal

Compressor

High performance, low noise inverter scroll compressors, adjust the speed to match required total cooling and heating load for efficient part load control.

Figure 3: Inverter Scroll Compressor Technology



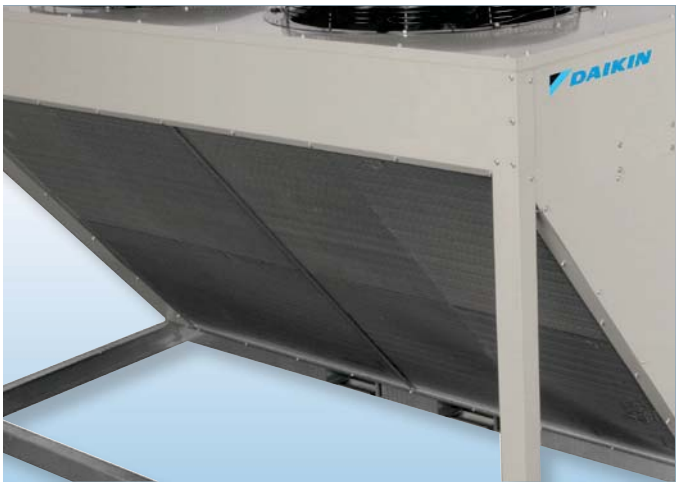
- The inverter scroll compressor has permanent magnets for high torque and maximum efficiency. At complete stop of the compressor, the magnets will position the rotor into the optimum position for a low torque start
- Refrigeration circuit includes both a low and high pressure transducer, high pressure safety switch and temperature sensors for the suction and discharge. All of the above devices are input to the unit controller and the values be displayed at the unit controller. Crankcase heaters and external thermal overload protection are also provided for compressor durability
- Refrigerant circuit includes a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability
- Unit is factory charged with environmental friendly and sustainable R-410A refrigerant
- The compressor is mounted on isolators for quieter operation
- Superior oil management is provided in one of two ways:
  - 3–15 tons, oil separators are provided at the discharge piping of each compressor
  - 16–28 tons, the inverter compressor has a low oil safety control

Outdoor Coil

All heat pump units use large face area outdoor coils, with integral sub-cooling circuit, are constructed with seamless copper tubes, mechanically bonded into aluminum plate-type fins with full drawn collars to completely cover the tubes for high operating efficiencies.

Most non-heat pump units use large face area, all aluminum, micro-channel coils with integral subcooling circuits. Size 5 and 6 units use fin tube coils. Micro-channel coils allow significant charge reduction and reduced maintenance costs.

Figure 4: Flexible Outdoor Coils Designed for Heat Pump or Cooling Only Operation



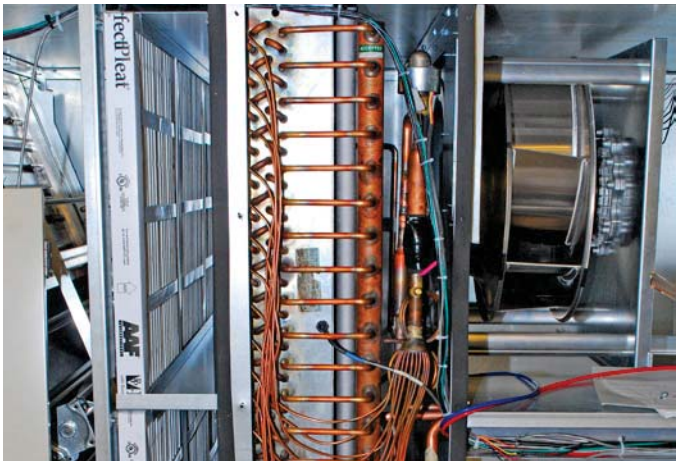
- Each outdoor air coil is factory leak tested with high-pressure air under water for reliable operation.
- Units are shipped with full operating charge of R-410A for quick start up
- The condensing unit consists of one or more direct drive condenser fans with low noise, patented profile blade design for quieter operation
- Fan motors have an ECM type motor for proportional control to make sure the space condition are met at ambient condition of 0–120°F
- A PVC coated, cross-welded, steel wire, coil guard is offered to provide protection for outdoor coil fins as an option
- Thermal overload and phase failure protection are provided for dependable and long lasting motor operation.
- The fan motor, include permanently lubricated bearings to reduce maintenance cost
- Sloped condenser coil design provides better hail protection for durability and reliable performance

Indoor Coil

Indoor coil section is installed in a draw through configuration to provide better dehumidification.

- Direct expansion cooling coils are fabricated of seamless riffled copper tubing that is mechanically expanded into enhanced aluminum plate fins for high efficiency
- Multi-row, staggered tube design coils with a minimum of 3 rows allow unbeatable part load and full load efficiencies
- Cooling coil includes an electronic controlled expansion valve to maintain the liquid sub-cooling and the superheat of the refrigerant system for extreme ambient conditions
- Each indoor air coil is factory leak tested with high-pressure air under water and completely piped and charged for quick start up and reliable operation
- Cooling coil is mounted in a stainless steel and positively sloped, ASHRAE 62.1 compliant, double sloped drain pan to improve IAQ

Figure 5: Rebel Indoor Coil Section



Heat Pump Heating

Evaporator coil, condenser coil, compressors and refrigerant circuit are designed for heat pump operation.

- The refrigerant circuit contains a 4 way reversing valve to provide heat
- The outdoor coil includes an electronic controlled expansion valve to control the refrigerant flow during heat pump operation
- The unit controller modulates the expansion valve to maintain compressor operation within the compressor operational envelope
- Hybrid heating option is provided for auxiliary
- The refrigerant system includes a pump-down cycle for durable operation

Modulating Hot Gas Reheat

All aluminum fully modulating hot gas reheat coil is provided for dehumidification control.

- Hot gas reheat coil includes aluminum tube micro channel design with high efficiency brazed aluminum fins for direct bonding and provides better heat transfer
- Modulating reheat coil provides precise temperature and humidity control to maintain required space conditions and reduces the chances of mold growth, sick building syndrome
- MicroTech III integrated controls with compressor and reheat coil energizes whenever dehumidification is needed without using additional energy
- Each indoor air coil is factory leak tested with high-pressure air under water and completely piped and charged for quick start up and reliable operation

Supply Fan

The airfoil single width, single inlet (SWSI) Class II construction supply fan with aluminum fan blades provides efficient and quiet operation at wide ranging static pressure and air flow requirements.

- Fan wheel is continuously welded to the hub plate and end rim for long lasting reliable operation
- Direct drive fan with no belts, sheaves, or bearings and permanently lubricated motors provides low maintenance cost
- Each fan assembly is dynamically trim balanced at the factory before shipment for quick start up and efficient operation
- MicroTech III integrated controls modulate the supply fan motor
  - 3–15 ton units use ECM motors
  - 16-28 ton units use VFDs
- Motor with thermal overload and phase failure protection is provided for motor long lasting operation

Variable Air Volume Control

MicroTech III proportionally controls the ECM motors or VFDs on the supply and exhaust fans, not only reduce fan energy and operating cost at part load conditions but also improves sound levels. Two supply fan control methods are offered:

- Fan motor speed is controlled by the unit controller based on space temperature for singlezone VAV applications
- Fan motor speed is controlled by the unit controller based on a duct static pressure sensor for traditional VAV applications

Exhaust Fan

Single width, single inlet (SWSI) Class II airfoil fans with aluminum blades provide efficient and quiet operation at wide ranging static pressure and air flow requirements.

- Fan wheel is continuously welded to the hub plate and end rim for long lasting, reliable operation
- Direct drive fan with no belts, sheaves, or bearings and permanently lubricated motors provides low maintenance cost
- Each fan assembly is dynamically trim balanced at the factory before shipment for quick start up and efficient operation
- MicroTech III integrated controls modulate the totally enclosed EC premium efficiency motor for efficient part load control
- Motor with thermal overload and phase failure protection is are provided for motor long lasting operation

Filters

Unit provides a draw-through filter section

- Both 2" – 4" filter tracks are provided to accept a 2"pre filter and a 4"after filter. MERV 8 prefilters are provided
- The filter section includes hinged access door equipped with ¼ turn latch for easy access

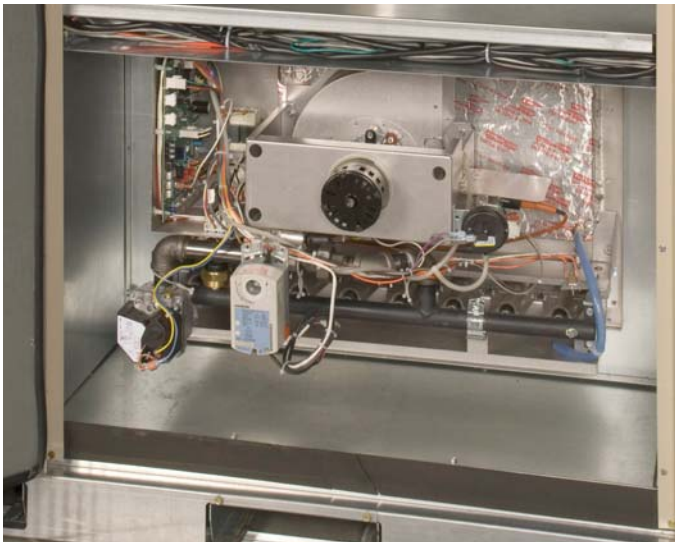
Figure 6: Easy Access Filters



Heating Section

Wide ranging natural gas, electric, hot water heat selections effectively handle almost any heating demand from morning warm-up control to full heat.

Figure 7: Gas Furnace



Gas Furnace

ETL certified heating modules provide a custom match to specific design requirement.

- Two stages, 5:1 or 10:1 modulating heating control provides the flexibility to solve diverse needs
- User has the flexibility to order heat exchanger tubes with 20 Gauge, G160, aluminized steel or stainless steel to meet your application needs
- The furnace has a tubular design with in-shot gas burner manifold and is installed downstream of the supply fan
- The module contains an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases to protect indoor air quality
- Each burner module provides flame roll-out safety protection switches and a high temperature limit switch for reliable operation
- Induced draft fan includes an airflow safety switch to prevent heating operation in the event of no airflow for occupant safety
- All burner assemblies are factory tested and adjusted prior to shipment
- Heating control is fully integrated into the unit's MicroTech III control system for quick startup and reliable control
- Optional field installed LP kits are available for staged heating modules

Electric Heat

ETL approved electric heat is factory assembled, installed and tested.

- Heating control is fully integrated into the unit's MicroTech III control system for quick startup and reliable control
- Multi-stage or SCR capability for application flexibility
- Durable low watt density, nickel chromium elements provide longer life
- Fuses are provided in each branch circuit to a maximum of 48 Amps per NEC requirements
- Single point power connection reduces installation cost
- For operational safeties electric heat includes automatic reset, and high temperature limit safety protection and an airflow safety switch to prevent electric heat operation in the event of no airflow

Figure 8: Electric Heat Coils



Hot Water Coil

1 and 2-row, low and high output options (3-row available for 16–28 ton units).

- Fully cased coil for better serviceability
- Factory installed coil vent and drain
- Piping vestibule for field installed piping control package
- Unit DDC control provides freeze protection and remote alarm signal
- DDC control ready with 2–10 volt wiring harness for field supplied and installed valve
- Each indoor air coil is factory leak tested with high-pressure air under water for reliable operation

Outdoor Air (OA) Monitor and Controller

Directly measures and controls outdoor ventilation air flow as low as 15 CFM per ton in order to improve indoor air quality (IAQ).

Model	Unit Size (tons)	Minimum CFM
Rebel	3–6	100
	7–15	200
	16–28	400

Thermal dispersion technology, independently calibrated sensors using NIST traceable standards, and laboratory testing of the entire assembly allow ventilation control accuracy of +/- 15%.

This outdoor air monitor is ideal for low velocity ventilation control, sensitivity to air flow increases as flow rate decreases, and accuracy is a percent of reading. Competitive pitot tube and pressure drop alternatives have very little sensitivity at low velocities and accuracy is a percent of full scale readings.

Monitor and controller comply with the measurement portion of the Outdoor Air Delivery Monitoring LEED® Point EQc1.

This option is factory installed, calibrated and tested to reduce installation costs and risks. End-users only need to enter the outdoor air flow set point into the MicroTech® III controller.



OA Monitor



OA Controller

OA Monitor/Controller Application

The outdoor air monitor measures the airflow and sends the appropriate analog signal to the MicroTech III controller, which in turn modulates the outdoor air damper to maintain proper ventilation levels. The desired outdoor air flow set point is directly entered at the MicroTech III controller keypad or is read from the BAS.

Measured outdoor air CFM can be displayed on the MicroTech III controller, as well as the outdoor air monitor, and MicroTech III writes this value to the BAS.

All BAS communication is done through the optional, MicroTech III, LON®, or BACnet® communication cards.

The outdoor air monitor option is available on all economizer, 100% outdoor air, and energy recovery options as well as the 0-30% outdoor air option.

Control accuracy may exceed +/- 15% when the energy recovery wheel bypass dampers are open. This only occurs during economizer operation, at which time more than enough ventilation air is provided.

Outdoor/Return Air Section

Rebel units are available with a 0% to 30% outdoor air damper or a 0% to 100% economizer or also a 100% outdoor air option.

- Outside air intake hood constructed from painted galvanized steel for longer equipment life
- Outside air hood includes moisture eliminator filters to prevent water from entering the unit for better IAQ
- Vinyl gasketed, motorized blade dampers provides efficient operation by reducing leakage during OFF cycles

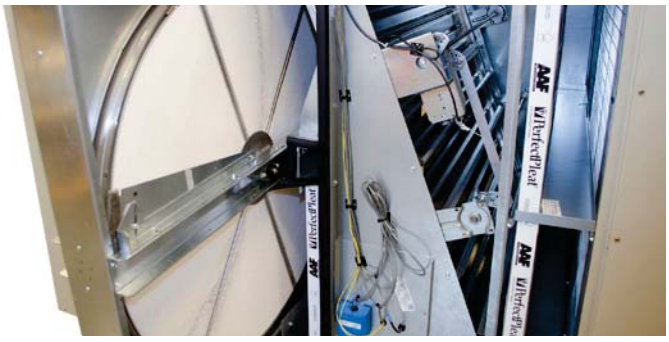
  Damper leakage is 1.5 cfm per square foot at 1" pressure. ASHRAE 90.1 minimum damper leakage is 267% greater than Rebel's damper leakage
- 0% to 30% damper is field adjusted to a fixed open position that is easily set using the MicroTech III keypad, allowing for a balance between IAQ and energy savings
- 0% to 100% option includes outside and return air dampers sized to handle 100% of the supply air volume for efficient and reliable operation
- 0% to 100%, fully functional, modulating economizer provides free cooling and reduces compressor energy and operating cost
- Economizer control is fully integrated into the unit's MicroTech III control system and features a spring-return actuator, adjustable minimum outside air set point and adjustable changeover
- Dry bulb or comparative enthalpy economizer changeover control is available to provide the most economical amount of outside air for "free" cooling
- Barometric relief dampers are standard for exhaust control and exhaust air out of the back of the unit and also include bird screen to prevent infiltration

Energy Recovery Wheel

Daikin energy wheels normally recover 70-75% of both sensible and latent energy. Considerable energy savings can result:

- Provide twice as much summer energy recovery as sensible-only alternatives, such as plate frame heat exchangers or run-around loops
- Energy recovery can increase the air conditioning capacity by 25% if the minimum outdoor air design is 33%. The cost savings on mechanical heating and cooling components offset the additional investment of energy recovery
- Winter humidification energy costs may be cut up to 60%
- Winter latent energy recovery lowers the dew point of exhaust air, compared to sensible-only alternatives, and allows frost-free operation to a lower ambient temperature
- Optional energy recovery wheel for increase efficiency for conditioning minimum outdoor air
- Unitary design for installation/rigging cost savings
- Single point power connection for decreased installation cost
- Slide-out wheel cassette & track for easy maintenance and cleaning
- Bypass dampers for increased efficiency during economizer operation
- Integrated unit control for control coordination between rooftop unit and wheel that controls the wheel speed
- Leaving wheel temperature sensors for wheel operation monitoring
- Integrated unit control with optimum leaving wheel temperature control to prevent over-heating the outdoor air
- Defrost options including ON/OFF control, Start/Stop and VFD speed modulation
- MERV 8 prefilters provided on outdoor and return air paths minimize dirt and cleaning

Figure 9: Energy Recovery Wheel



Electrical

Units are completely wired and tested at the factory to provide faster commissioning and start-up.

- Wiring complies with NEC requirements and all applicable UL standards
- For ease of use, wiring and electrical components are number coded and labeled according to the electrical diagram
- A 115 V GFI convenience receptacle requiring independent power supply for the receptacle is optional
- An optional unit powered 20 amp 115 V convenience receptacle, complete with factory mounted transformer, disconnect switch, and primary and secondary overload protection, eliminates the need to pull a separate 115 V power source
- Supply air fan, compressor, and condenser fan motor branch circuits have individual short circuit protection. Unit includes knockouts in the bottom of the main control panels for field wiring entrance
- A single point power connection with power block is standard and a terminal board is provided for connecting low voltage control wiring
- 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor are for provided with the unit
- For better serviceability an optional non-fused disconnect switch is optionally mounted inside the control panel and operated by an externally mounted handle for disconnecting electrical power at the unit

Intelligent Equipment™

Intelligent Equipment (IE) from Daikin Applied is a secure, cloud-based controls solution that enables delivery of equipment and/or system information to customers via web or mobile devices.

A power measurement module and communications gateway installed on Daikin equipment enables the unit to be directly connected to the Internet via wireless (cellular, WI-FI) or local area network (LAN), providing management, monitoring control analysis and decision-making functionality for Daikin rooftop systems and the facility.

Features

- Remote monitoring and control of Daikin rooftop units
- Remote servicing capabilities
- Integration to the Energy Star® Portfolio Manager®
- Advanced data analytics including equipment performance, financial performance and building Comfort Index metrix based on ASHRAE Standard 55-2010
- Dynamic user dashboards with photo-realistic graphics and responsive-design interface optimized for users' mobile devices, tablets or PCs
- Secure, role-based user access

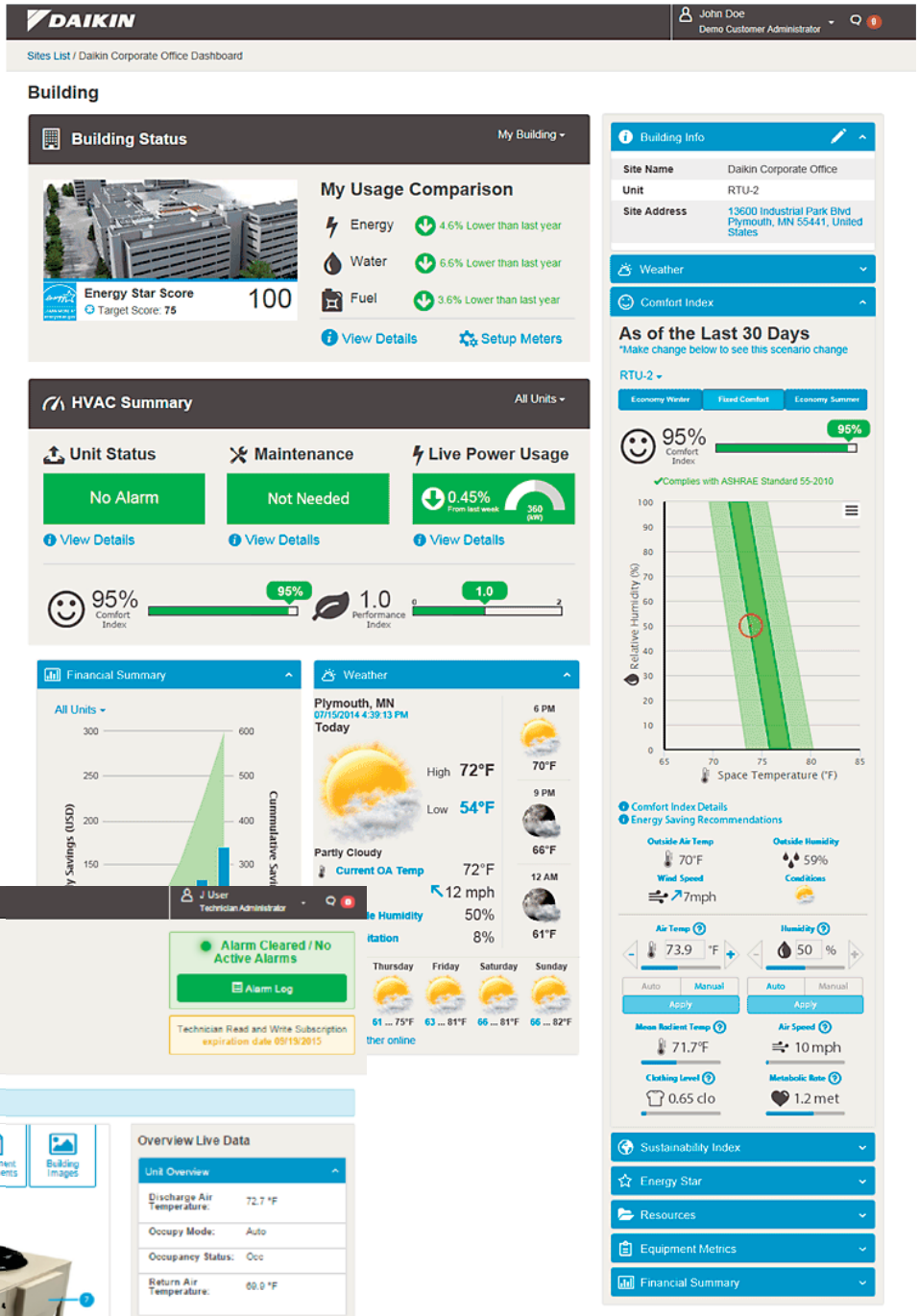
Benefits

- Informed decision-making
- Increased equipment efficiency
- 24/7 monitoring capability
- Real-time equipment information
- Accelerated equipment payback
- Historical performance data
- Can be used with, or without, an existing building automation system (BAS)

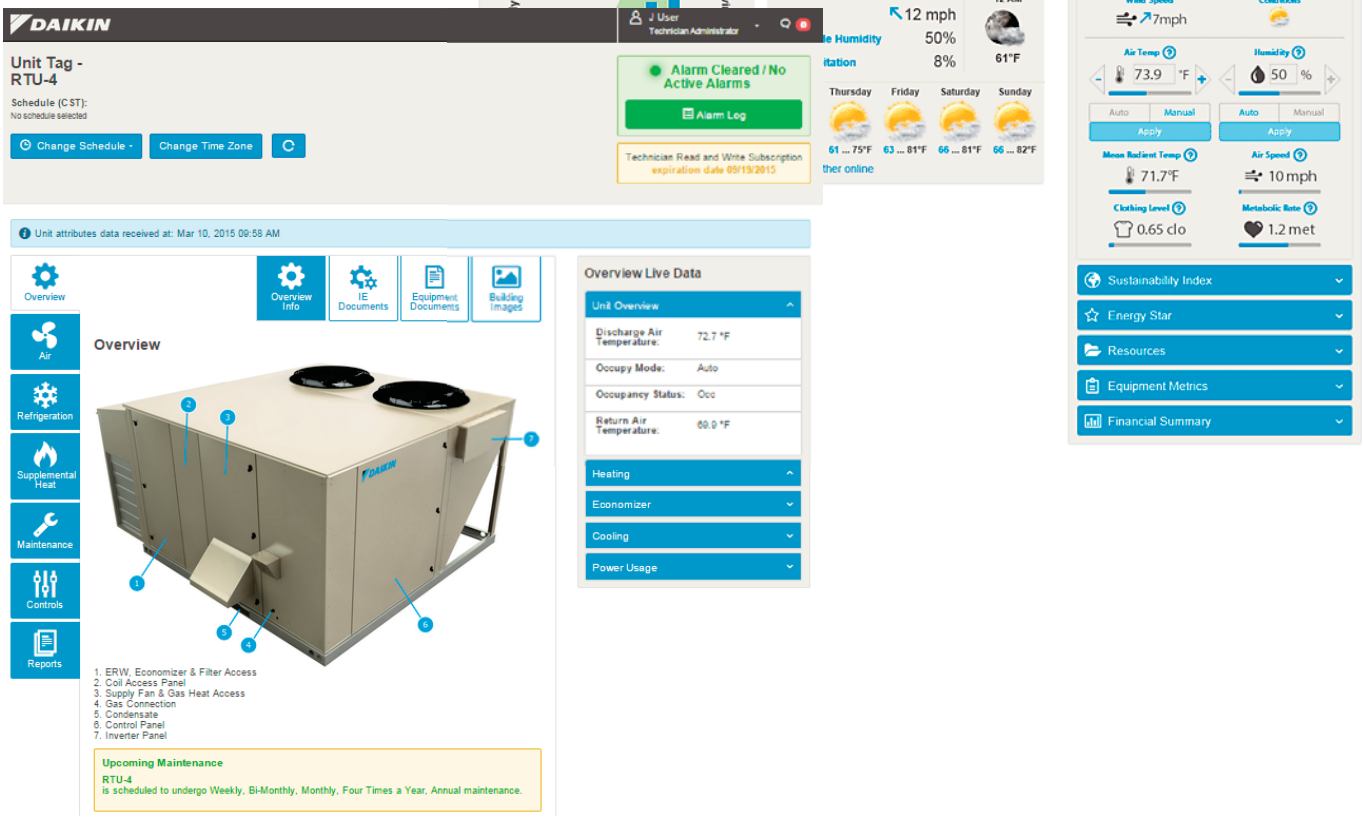
Also see ASP 31-384 for more details.

Figure 10: Intelligent Equipment Dashboards

Customer Dashboard



Technician Dashboard



Modulating Hot Gas Reheat

The reheat coil option comes complete with an aluminum micro-channel coil and modulating hot gas valves for leaving air temperature control.

On a call for dehumidification, the unit controls will modulate the compressor to maintain desired DX coil leaving air temperature and dew point. Hot gas from the unit condenser will be routed to an indoor coil downstream of the DX coil to reheat the air. Hot gas reheat valves (Figure 11) will control how much hot gas is routed to the indoor coil to maintain desired discharge air temperature from the unit.

Figure 11: Dual 2-Way Modulating Valve Refrigeration Schematic (Cooling Model Shown)

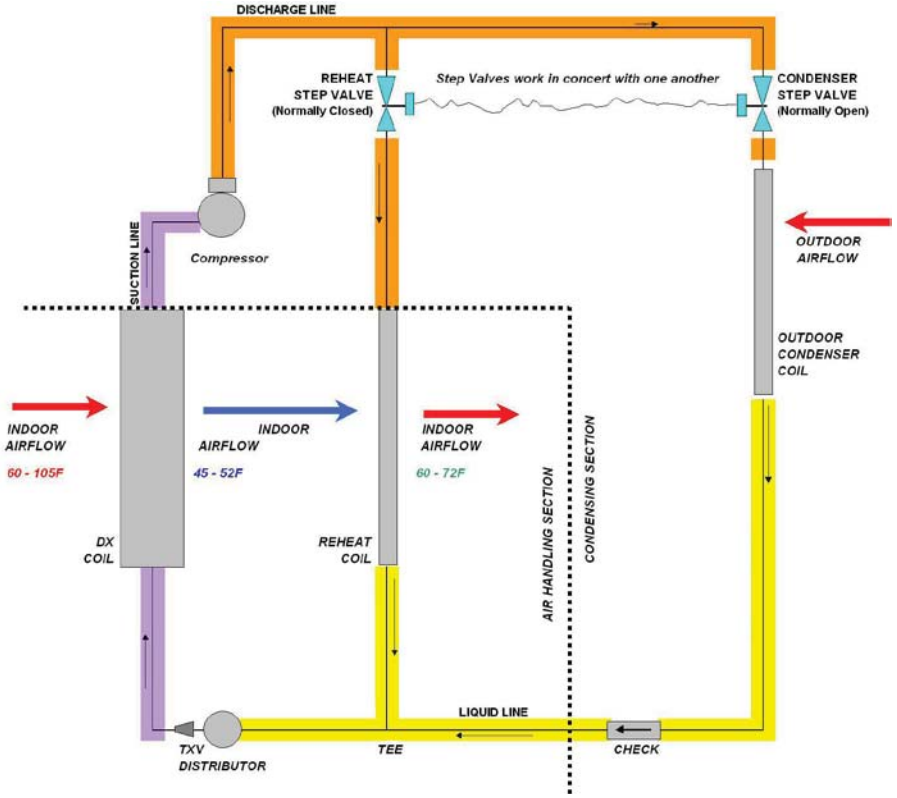
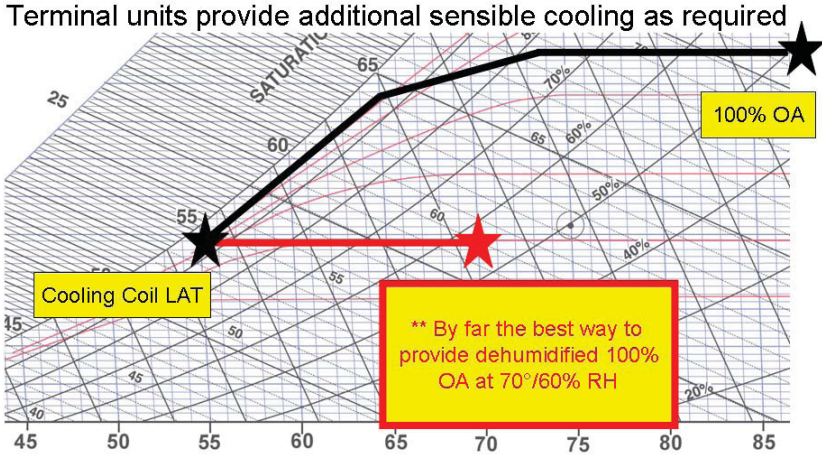


Figure 12: Ideal for Neutral Air Ventilation Control

- The rooftop mainly dehumidifies the required ventilation air
- Terminal units provide additional sensible cooling as required



Dehumidification Initiation

An analog sensor is mounted in the return duct, the space, or outdoors to sense relative humidity. The location is selected by setting the sensor location value on the keypad to return, space, or Outdoor Air Temperature. Outdoor Air Temperature can only be selected for units with Discharge Air Temperature control. Dehumidification is disabled when the unit is in either the heating or minimum Discharge Air Temperature state. When dehumidification is enabled, dehumidification operation is initiated when humidity control is set to either relative humidity or dew point and that value rises above the appropriate setpoint by more than half of its deadband. Economizer operation is disabled in the dehumidification mode so the unit immediately transitions to cooling if dehumidification is initiated in economizer state.

Dehumidification Termination

Dehumidification is terminated if the selected variable, relative humidity or dew point, drops below the appropriate humidity setpoint by more than half its deadband. Dehumidification is also terminated if cooling is disabled for any reason or the unit enters either the heating or minimum Discharge Air Temperature state. Compressor capacity is reduced and eventually shut off when compressor cycle timers are satisfied.

Control & Arrangement

In conjunction with dehumidification, MHGRH is used to raise the temperature of the cooled air to a desirable value. MHGRH is comprised of a parallel coil arrangement, with dual modulating reheat valves (which operate in concert with one another) and a check valve.

During dehumidification control with modulating hot gas reheat (MHGRH), an analog signal (0-10Vdc) is controlled as described below.

- A PI loop is used to control the HGRH valves to maintain the discharge air temperature from the reheat coil
- Compressor staging and speed during reheat (or dehumidification) will be controlled by the leaving DX coil temperature. For increased dehumidification during reheat, the standard default compressor staging range is 45–52°F
- When dehumidification is active in the cooling state, the reheat set point equals the Discharge Air Temperature cooling setpoint. For Discharge Air Temperature units, this is the normal Discharge Air Temperature set point resulting from any reset. For zone control units, this set point is the result of a PI loop based on the control temperature
- Communication with the reheat control valves is accomplished by providing a 0–10 Vdc signal to a pair of interface boards which in turn supply the control signal to the reheat valves (step type)
- In the fan only state, no sensible cooling is required, but dehumidification mode will still be enabled if the dew point or humidity sensor is not satisfied. Reheat set point varies from a maximum value (default 65°F) when the control temperature is at or below the heating changeover setpoint to a minimum value (default 55°F) when the control temperature is at or above the cooling changeover setpoint
- In the reheat mode, the minimum position for the reheat valves is 10% (1.0 Vdc). The controller will modulate the reheat valves from this starting position
- Reheat valve(s) must be at 0% (0 Vdc) position before starting the first compressor in the reheat circuit to prevent pressure spikes
- Upon termination of dehumidification (reheat), the maximum ramp down or decay rate of the reheat control valves shall be 1% per sec (or 0.1V per sec)
- Upon termination of dehumidification (reheat), staging of compressor(s) is delayed for 1 minute after reheat capacity = 0% (0 Vdc)
- Every 24 hours, the reheat control valves will be driven to their maximum position (10Vdc) and then returned to their normal operating position (0Vdc). If unit is operating in cooling or dehumidification (reheat) at the prescribed time it will be deferred to the next time
- Dehumidification status can now be found under the MicroTech III main system menu. Reheat capacity (valve position) can also be found under the main system menu, display based on percentage (0-100%)

Daikin Rooftop units are intended for use in normal heating, ventilating, and air conditioning applications. Consult your local Daikin sales representative for applications involving operations at high ambient temperatures, high altitudes, non-cataloged voltages, or for job specific unit selections that fall outside of the range of the catalog tables.

For proper operation, units should be rigged in accordance with instructions stated in IM 1125. Fire dampers, if required, must be installed in the ductwork according to local and/or state codes. No space is allowed for these dampers in the unit. Follow factory check, test and start procedures explicitly to achieve satisfactory start-up and operation (see IM 1125). Most rooftop applications take advantage of the significant energy savings provided with economizer operation. When an economizer system is used, mechanical refrigeration is typically not required below an ambient temperature of 50°F. Standard DPS refrigeration systems are designed to operate in ambient temperatures down to 25°F.

Unit Location

The structural engineer must verify that the roof has adequate strength and ability to minimize deflection. Take extreme caution when using on a wooden roof structure. Unit condenser coils should be in a location that avoids any heated exhaust air.

Allow sufficient space around the unit for maintenance/service clearance. Refer to Figure 13 on page 17 for recommended clearances. Consult your Daikin sales representative if available clearances do not meet minimum recommendations. Where code considerations, such as the NEC, require extended clearances, these take precedence.

Service Clearance

Allow for recommended service clearances as shown in Figure 13. Provide a roof walkway along the sides of the unit for service and access to controls and components. Contact your Daikin sales representative for service requirements less than those recommended.

Curb Installation

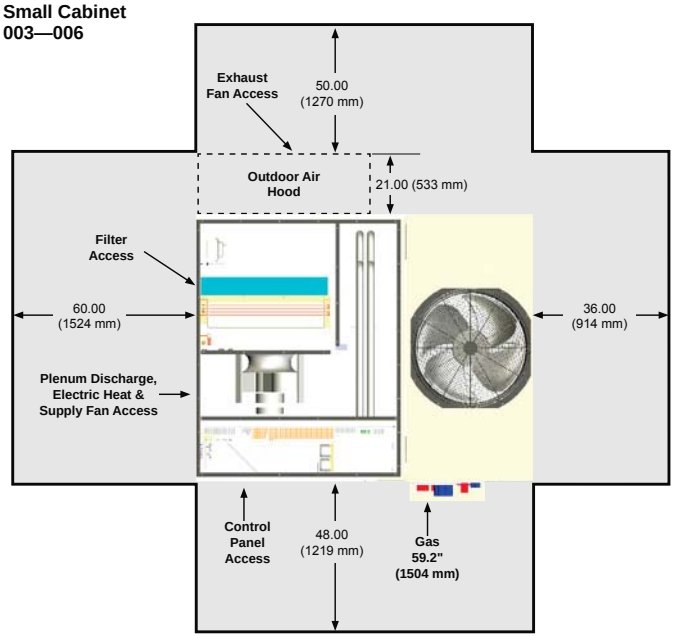
The roof curb is field-assembled and must be installed level (within 1/16" per foot side to side). A sub-base must be constructed by the contractor in applications involving pitched roofs. Gaskets are furnished and must be installed between the unit and curb. For proper installation, follow NRCA guidelines. Typical curb installation is illustrated in Figure 14 on page 18 and Figure 15 on page 19.

In applications requiring post and rail installation, an I-beam securely mounted on multiple posts should support the unit on each side. In addition, the insulation on the underside of the unit should be protected from the elements.

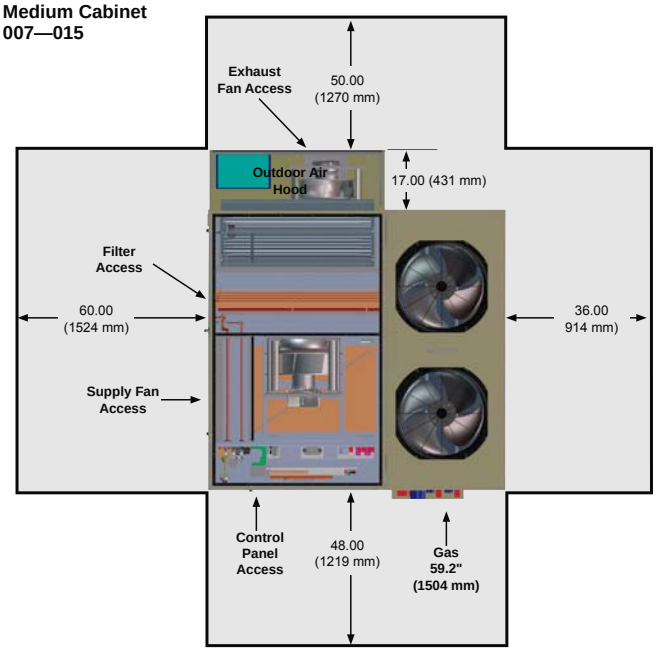
Applications in geographic areas subjected to seismic or hurricane conditions must meet code requirements for fastening the unit to the curb and the curb to the building structure.

Figure 13: Service Clearances

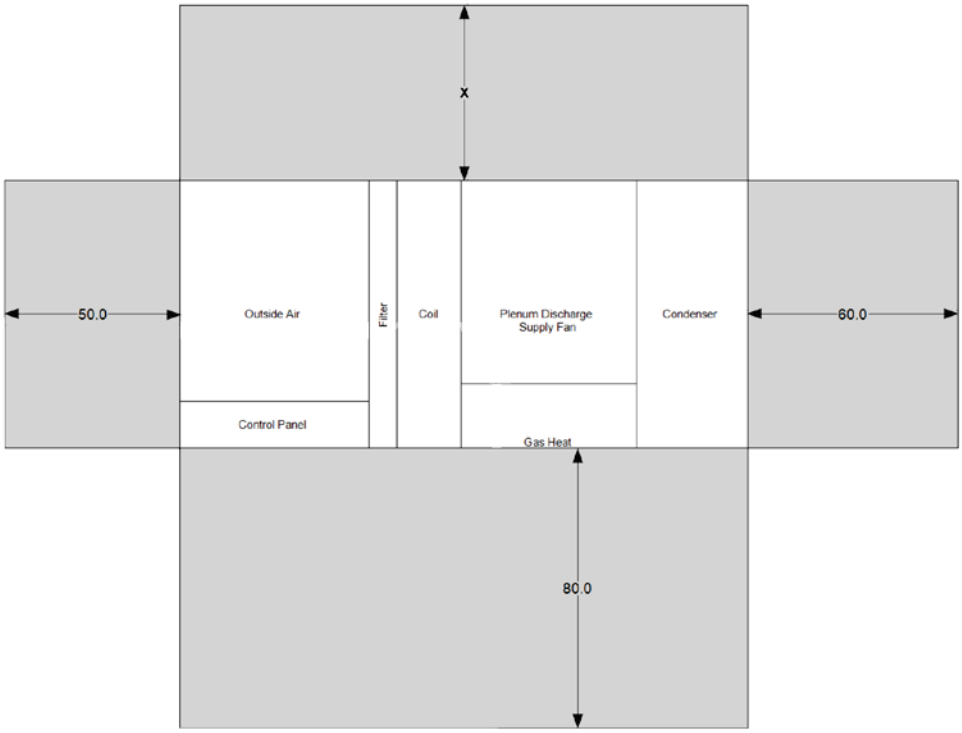
Small Cabinet
003—006



Medium Cabinet
007—015



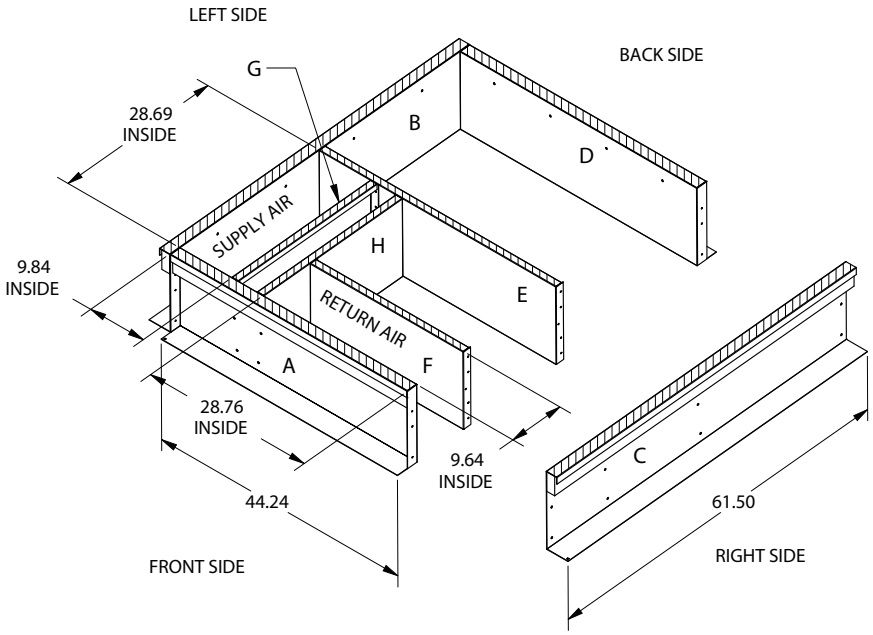
Large Cabinet
016—028



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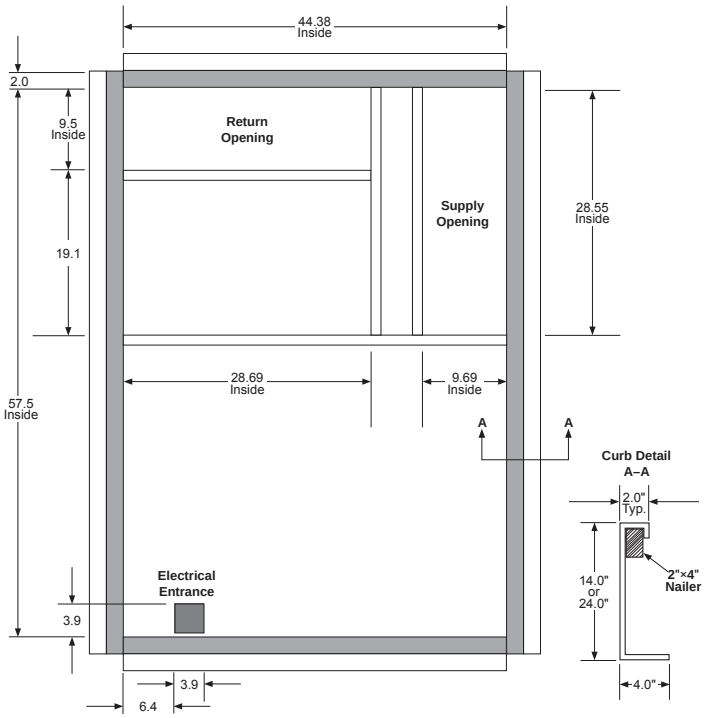
1. Center of gravity height = 34.1"
2. Total weight = 4001 lbs.
3. X = 60" with ERW, 50" without ERW

Figure 14: Roof Curb Assembly (DPS 003—006)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Small Cabinet



Roof Curb for ERW – Small Cabinet

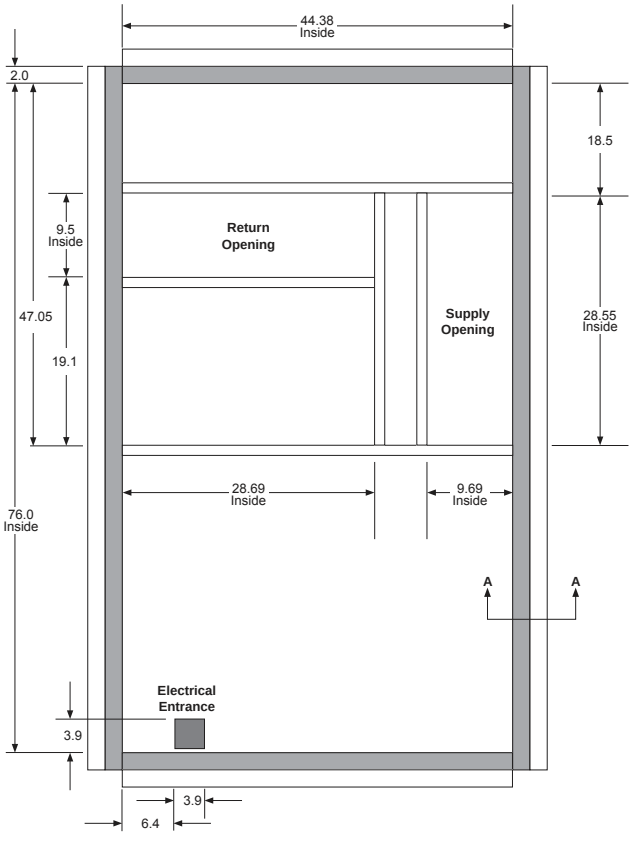
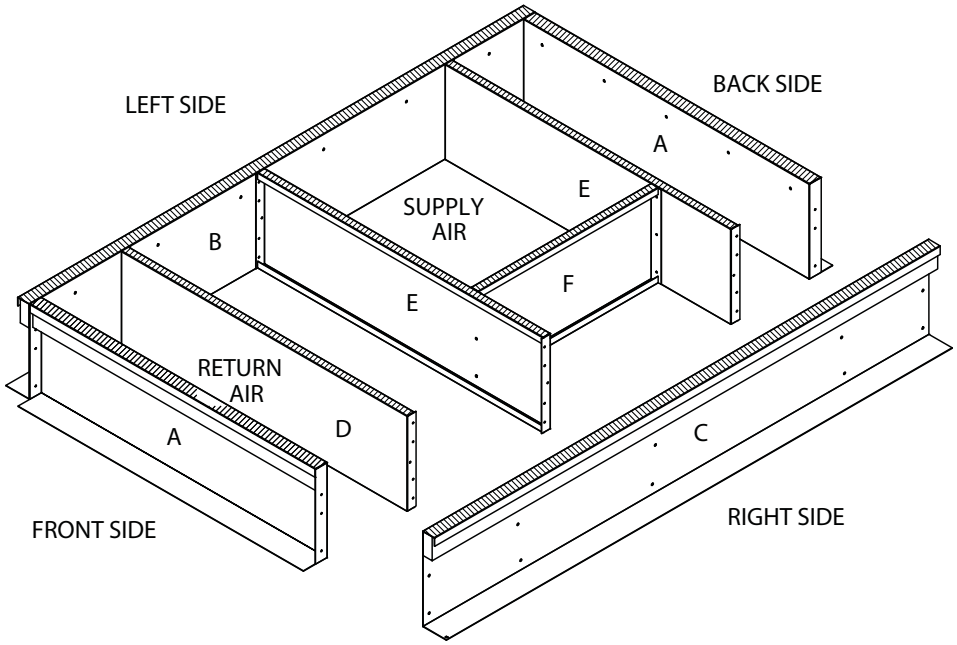
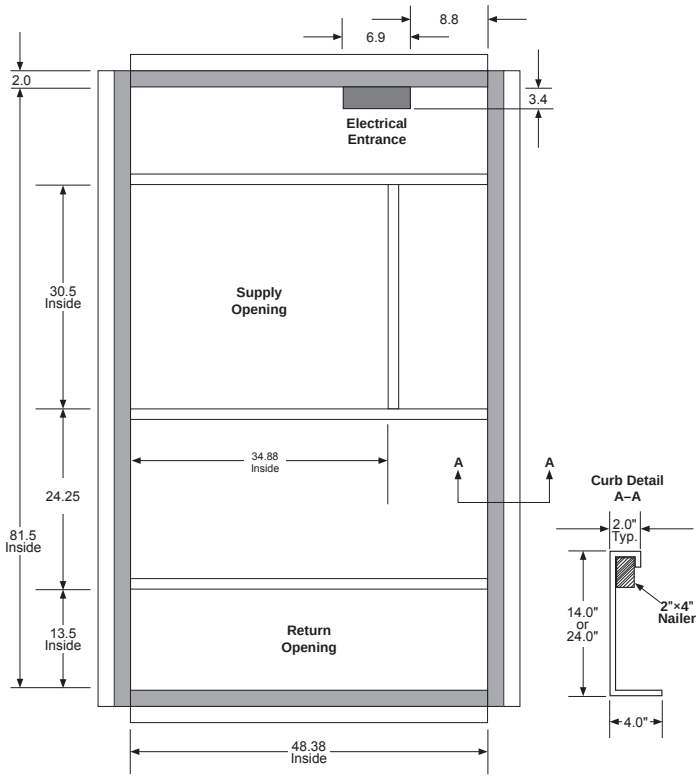


Figure 15: Roof Curb Assembly (DPS 007–015)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Medium Cabinet



Roof Curb for ERW – Medium Cabinet

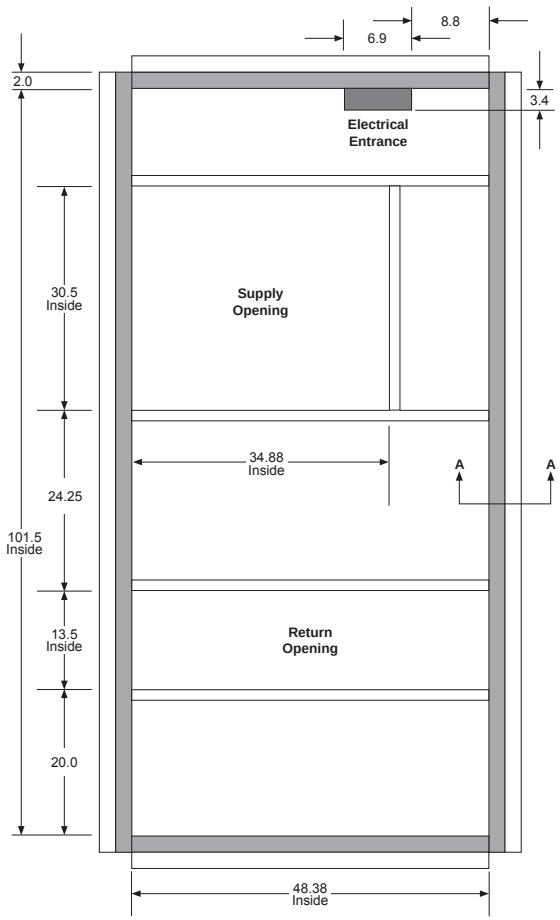
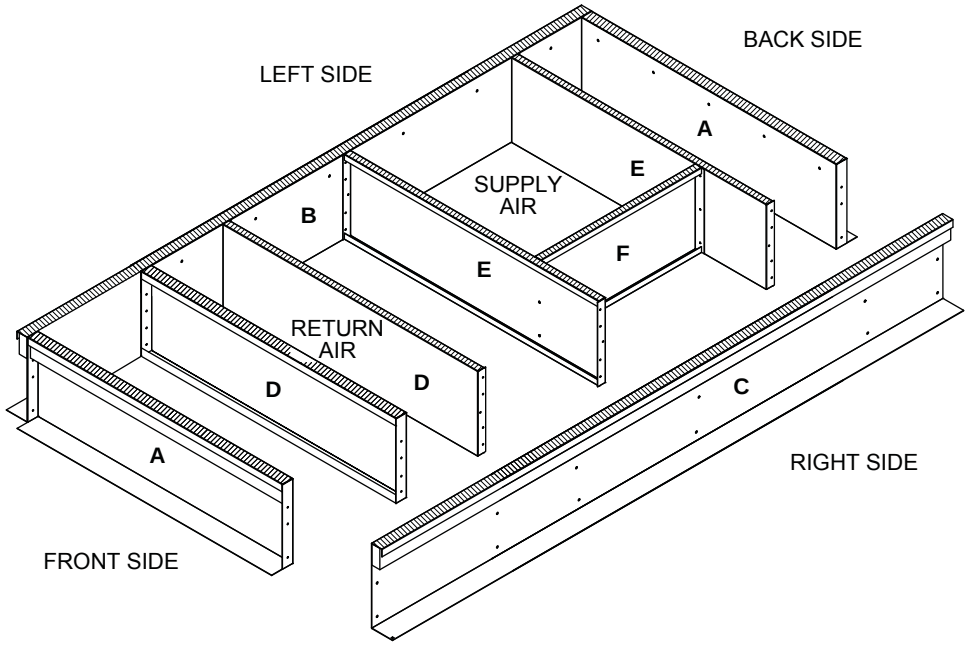
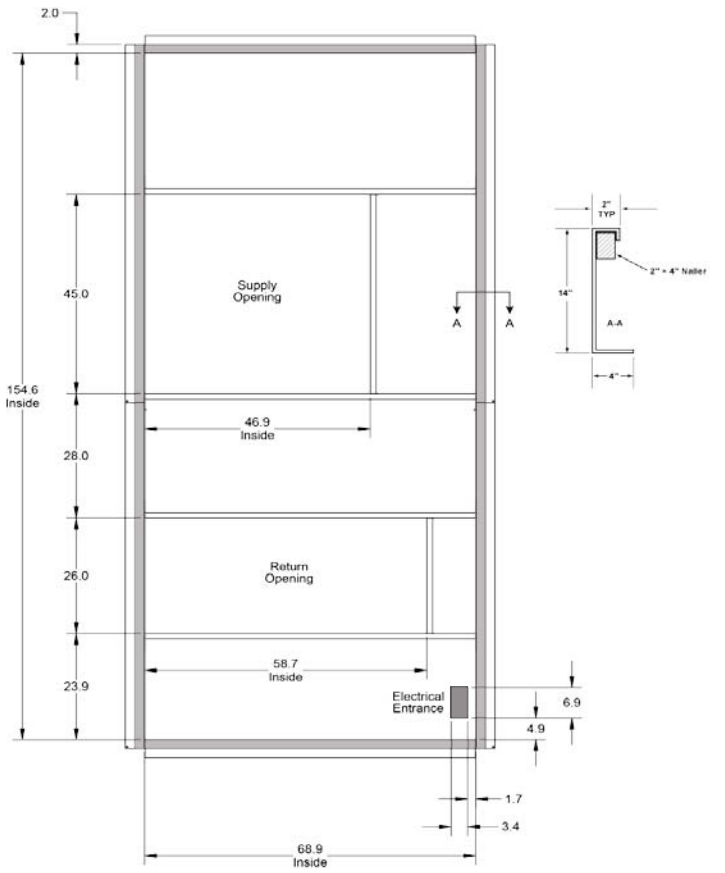


Figure 16: Roof Curb Assembly (DPS 016–028)[1]

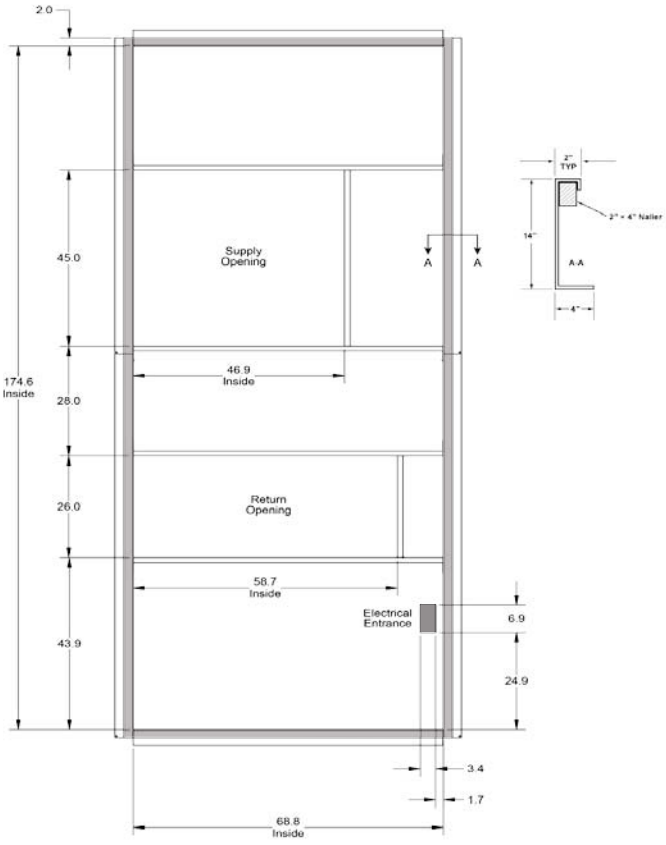


NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Large Cabinet



Roof Curb for ERW – Large Cabinet



Acoustical Considerations

Good acoustical design is critical for any installation and should start at the earliest stages in the design process. Common sound paths for rooftop equipment must be addressed are:

- Radiated sound through the bottom of the unit (air handling section and condensing section) and into the space
- Radiated sound to the property line
- Structure-borne vibration from the unit to the building
- Airborne sound through the supply air duct
- Airborne sound through the return air duct

Locating rooftop equipment away from sound sensitive areas is critical and the most cost effective means of avoiding sound problems. If possible, rooftop equipment should always be located over less sensitive areas such as corridors, toilet facilities or auxiliary spaces and away from office areas, conference rooms and classrooms. Some basic guidelines for good acoustical performance are:

- Provide proper structural support under all areas of the unit
- Always locate the unit's center of gravity close to a main support to minimize roof deflection
- Use a concrete deck or pad when a unit has to be located over an occupied space where good acoustics are essential
- Only the supply and return air ducts should penetrate the acoustical material and decking within the curb perimeter, and the openings must be sealed once the duct is installed
- Don't overlook the return air path. Never leave a clear "line of sight" into a return or exhaust fan; always include some duct work (acoustically lined tee) at the return inlet
- Place acoustical material in the area directly beneath the condensing section
- Select acoustical material that discourages microbial growth
- Minimize system static pressure losses to reduce fan sound generation
- Design duct systems to minimize turbulence
- Account for low frequency duct breakout in system design. Route the first 20 ft. of rectangular duct over non-sensitive areas and avoid large duct aspect ratios. Consider round or oval duct to reduce breakout

There are many sound sources in rooftop systems. Fans, compressors, condenser fans, duct take-offs, etc., all generate sound. For guidelines on reducing sound generation in the duct system, refer to the ASHRAE Applications Handbook. Contact your local Daikin sales representative for equipment supply, return and radiated sound power data specific to your application.

Ductwork Considerations

A well-designed duct system is required to allow the rooftop equipment to provide rated performance and to minimize system resistance and sound generation. Duct connections to and from units should allow straight, smooth airflow transitions. Avoid any abrupt change in duct size and sharp turns in the fan discharge. Avoid turns opposed to wheel rotation since they generate air turbulence and result in unwanted sound. If 90° turns are necessary, use turning vanes. Refer to the ASHRAE Applications Handbook for specific guidelines relevant to rooftop equipment.

Return Duct

The return path is the most often overlooked. A section of return duct is required to avoid a "line of sight" to the return air opening and to provide attenuation of return air sound. Install an insulated tee with a maximum duct velocity of 1000 to 1200 feet per minute. Extend the duct 15 feet to provide adequate attenuation.

Supply Duct

Insulate supply air ductwork for at least the first 20 feet from the unit. Consider the use of round or oval ductwork, as it significantly reduces low frequency breakout noise near the equipment. If rectangular duct is used, keep the aspect ratio of the duct as low as possible. The large flat surfaces associated with high aspect ratios increase low frequency breakout to the space and can generate noise, such as "oil canning." The maximum recommended supply duct velocity is 1800 to 2000 feet per minute.

Duct High Limit

A Daikin Packaged System with VAV control includes a duct high limit switch as a standard feature that is of particular importance when fast acting, normally-closed boxes are used.

Vibration Isolation

Make duct attachments to the unit with a flexible connection. Economizer and Exhaust Fan Application Rooftop economizer applications usually require exhaust fans to properly control building pressure and maintain minimum ventilation. The air balancer must adjust the outdoor air damper to provide minimum ventilation settings. The EAF is normally-off during non-economizer operation. During these minimum outdoor air conditions, the system essentially acts like a supply fan only system.

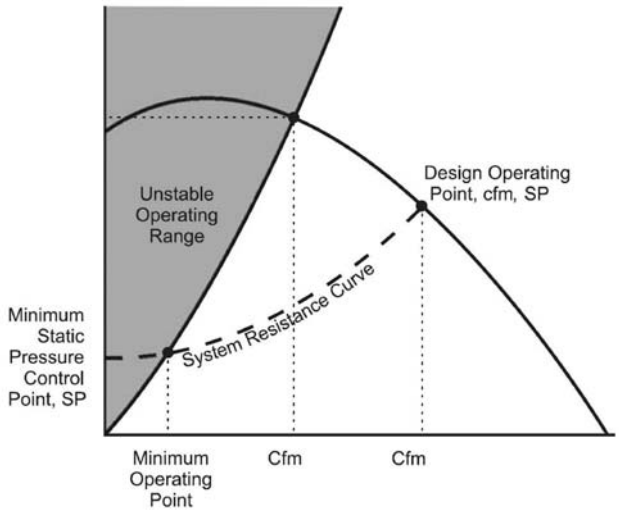
Smoke and Fire Protection

Due to the wide variation in building design and ambient operating conditions our units are applied, we do not represent or warrant that our products are fit and sufficient for smoke, fume, and fire control purposes. The owner and a fully qualified building designer are responsible for meeting all local and NFPA building code requirements with respect to smoke, fume, and fire control. The unit's control panel has a terminal block that a supply air and return air smoke detector can be wired to. An optional return air smoke detector is offered. Any other smoke detector, its installation, and the wiring to the unit controller are all field supplied.

Variable Air Volume Application

Rebel units include ECM supply and exhaust fans to provide variable air volume (VAV) control as shown in Figure 17. Daikin Rebel variable air volume systems (VAV) employ the concept of varying the air quantity to a space at a constant temperature, thereby balancing the heat gains or losses and maintaining the desired room temperature. This ability to reduce supply air quantities not only provides substantial fan energy savings at partial load conditions, but it also minimizes equipment sizing. Variable volume systems offer the following advantages:

Figure 17: Variable Air Volume (VAV) Control



- Lower system first cost by using system diversity to reduce equipment and duct sizes
- Lower operating costs by reducing fan energy demands, especially at part load conditions
- Provides excellent acoustics at lower air flows

In placing a duct static pressure sensor, locate a pressure tap near the end of the main duct trunk. Adjust the static pressure setpoint so that at minimum airflow all of the terminals receive the minimum static pressure required plus any downstream resistance. Locate the static pressure sensor tap in the ductwork in an area free from turbulence effects and at least ten duct diameters downstream and several duct diameters upstream from any major interference, including branch takeoffs.

Single Zone Variable Air Volume Application

A unit configured for single zone VAV will use discharge air control for mechanical cooling and heat, with VAV control of the supply air fan based upon the space or return air temperature. During cooling, the MicroTech III controller increases the ECM fan motor speed when the space temperature rises above the setpoint, and it decreases fan speed when space temperatures approach the setpoint. Mirror-image heating control is also provided. The MicroTech III controller will also use the control temperature to transition between cooling, fan only, and heating modes. Singlezone variable volume systems offer the following advantages:

- Lower system first cost
- Lower operating costs by reducing fan energy demands, especially at part load conditions
- Provides excellent acoustics at lower air flows

Fan Operating Range

The acceptable system operating range of the Daikin rooftop is determined by all of the following characteristics. Each of these limiting factors must be considered for proper performance and component design life:

- Unstable fan operation
- Maximum fan rpm
- Maximum cabinet static pressure
- Maximum face velocity (cooling coil is most important)
- Minimum furnace velocity
- Turndown capability on VAV applications
- Compressor operating pressures

Indoor Fan and Motor Heat

The indoor fan and motor electrical consumption is a sensible cooling load approximately equal to 2.8 MBh per bhp (depending slightly on motor efficiency). The fan and motor temperature rise is equal to Btuh/(1.08 × cfm) and is typically about 3°F.

Altitude Adjustments

Fan Curve Performance

Fan curve performance is based on 70°F air temperature and sea level elevation. Selections at any other conditions require adjustment for air densities listed in Table 1 on page 23. Higher elevations generally require more rpm to provide a given static pressure but less bhp due to the decrease in air density.

Example:

Assume 2,000 cfm is required at 1.00" TSP. The elevation is 5000 ft. and 70°F average air temperature is selected. A 14" SWSI airfoil fan is selected.

1. The density adjustment factor for 5000 ft. and 70°F is 0.83.
2. TSP must be adjusted as follows: 1.0" / 0.83 = 1.20".
3. Locate 2,000 cfm and 1.2 on the fan curve. Rpm = 1720 and bhp = 0.53.
4. Consumed fan power at design = 0.53 bph × 0.83 = 0.44 bhp.

Table 1: Temperature and Altitude Conversion Factors

Air temp (°F)	Altitude (feet)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
-20	1.20	1.16	1.12	1.08	1.04	1.00	0.97	0.93	0.89
0	1.15	1.10	1.08	1.02	0.99	0.95	0.92	0.88	0.85
20	1.11	1.06	1.02	.098	0.95	0.92	0.88	0.85	0.82
40	1.06	1.02	0.98	0.94	0.91	0.88	0.84	0.81	0.78
60	1.02	0.98	0.94	0.91	0.88	0.85	0.81	0.79	0.76
70	1.00	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74
80	0.98	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72
100	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.70
120	0.92	0.88	0.85	0.81	0.78	0.76	0.72	0.70	0.67
140	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.78	0.65

Condenser Performance

Altitudes greater than sea level require a derate in condenser and cooling performance that can be estimated as follows:

For altitudes up to 6000 feet:

- Cooling capacity decrease factor (all sizes) = 0.5% per 1000 feet
- Compressor kW increase factor = 0.6% per 1000 feet

For altitudes above 6000 feet, consult the factory. The actual derate varies with each individual unit and design conditions. Your local Daikin representative can provide exact performance data.

Furnace Performance

Gas heat performance data is based on standard 70°F air temperature and zero feet altitude (sea level).

For altitudes between 2000 to 6000 feet, the gas burner must be derated 4% for every 1000 feet of altitude.

Example:

A 400 MBh furnace at an altitude of 3000 feet is derated (0.04 × 3 = 0.12). At 400 MBh input (400 × 0.12 MBh), the actual input is (400 - 48 = 352 MBh) at 3000 feet.

For altitudes above 6000 feet, consult the factory.

System Operating Limits

Daikin DPS systems are designed to operate over an extensive operating range. However, for proper system operation some limits do apply.

To help prevent moisture blow-off, design guidelines have been established for cooling coil selection. For applications outside of these limits, consult your Daikin sales representative.

In addition to maximum face velocity limitations, minimum velocity guidelines must also be followed. In order to maintain proper refrigeration performance, the minimum coil face velocity is 175 ft./min. When selecting a variable air volume unit, it is necessary to design the system such that the 175 ft./min. limit is maintained at light load conditions.

Condensate Drainage

Provide all drain pans with a properly sized p-trap to allow free drainage of coil condensate. For trap sizing, follow instruction given in IM 842. Run all traps and drain lines full size from the threaded unit connection to the roof drain.

Zone Sensor Placement

Placement of the zone temperature sensor is critical for proper and economical operation of the heating and cooling system. It is generally recommended that the space sensor be located on an inside wall (3 to 5 feet from an outside wall) in a space having a floor area of at least 400 square feet. Do not locate the sensor below the outlet of a supply diffuser, in the direct rays of the sun, on a wall adjacent to an unheated or abnormally warm room (boiler or incinerator room), or near any heat producing equipment. Where zone sensor placement is a problem, all zone control systems, as standard, have the capability to use a return air sensor for heating and cooling.

Unit Wiring

All units require three phase, 60 Hz, 208, 230, 460, or 575 volt power supply. All units include branch circuits and short circuit protection and are available with a power block or nonfused disconnect switch. Each unit is provided with a 115 V convenience outlet. Per the NEC, this circuit must be fed independent of the main unit power supply.

All wiring must be installed in accordance with the National Electric Code (NEC) and local codes.

Winter Shipment

Flat bed shipment in winter can expose units to harsh road chemicals. Since equipment size and configuration precludes covering during transit, wash units free of these chemicals as soon as possible to help prevent corrosion.

Coil Freeze Protection

When applying roof-mounted equipment in areas that experience subfreezing conditions, coil freeze protection measures must be provided. Subfreezing temperatures can adversely affect water and steam coils during controlled or uncontrolled unit shutdowns and even during unit operation. Daikin economizer dampers are arranged to direct the outside and return air streams toward each other, however, there may not always be a uniform unit temperature profile under all load and ambient temperatures. Some temperature stratification will occur, particularly at low ambient temperatures and the associated reduced airflow inherent with VAV systems.

Glycol is strongly recommended as a positive means of freeze protection for water coils. No control sequence can prevent coil freezing in the event of a power failure or equipment malfunction. During those periods, glycol is the only positive means of freeze protection. When selecting water coils, specify glycol to account for performance differences.

Parallel Air Paths on Energy Recovery Wheel Applications

Economizer Units

There are three sets or parallel air flow paths on economizer units:

Set 1: OA and RA paths to the SAF

- The OA path APD is normally greater than the RA path APD. Therefor, the air balancer must adjust the RA dampers to not open fully so that sufficient OA is achieved
- The RA path includes return duct ESP. Normally, the SAF handles both of these paths. Therefore, the EAF need not handle the return duct ESP. However:
  - The RA path is not open during economizer operation, so the EAF must handle return duct ESP during economizer operation or excessive positive building pressure will occur
- For VAV units, note that RA cfm during economizer operation normally is less that design return cfm
- An energy analysis must be careful not to overwhelm the EAF with return duct ESP except during economizer cooling

Set 2: OA wheel and OA bypass path to the SAF

Set 3: EA wheel and bypass path to the EAF

100% Outdoor Air Units

There are no parallel flow paths in a 100% OA unit. Instead, there is one counter-flow path (OA and EA paths throughout the wheel). The EAF must be sized for design return duct cfm and ESP as well as the wheel and wheel prefilter pressure drop.

Figure 18: Energy Wheel Parallel Air Path

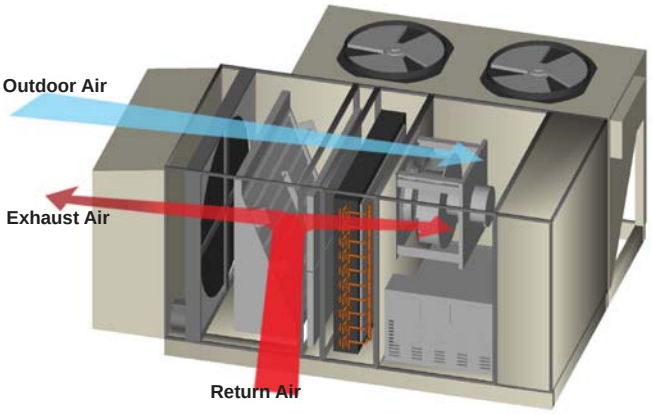


Table 2: Physical Data—Standard Units DPS 003 through 028

Model	Small Cabinet				Medium Cabinet				Large Cabinet				
	003	004	005	006	007	010	012	015	016	018	020	025	028
Cooling only performance													
Gross Cooling capacity (tons)	3	4	5	6	7.5	10	12	15	15.5	17.5	20.1	25	27.5
Nominal airflow (cfm)	1125	1500	1875	2100	2450	3500	4200	5250	5900	6600	7600	9500	10400
EER[1]	13.5	12.4	13.0	11.6	12.6	12.5	12.1	11.0	Consult Factory			11.3	10.1
IEER[1] or SEER	16.9	17.0	18.5	19.8	20.6	19.4	18.5	18.0				18.3	17.7
Heat pump performance[4]													
High Temperature Capacity @ 47°F (MBh)	32	43	54	64	78	105	134	164	—	—	—	—	—
COP @ 47°F or HSPF[5]	9.2	8.9	8.5	3.69	3.66	3.42	3.33	3.64	—	—	—	—	—
Low Temperature Capacity @ 17°F (MBh)	20	24	33	39	47	61.5	77	91	—	—	—	—	—
COP @ 17°F[5]	N/A	N/A	N/A	2.54	2.42	2.38	2.32	2.25	—	—	—	—	—
Electric heat performance													
Control Options	2/4/SCR				4 stage/SCR				4 stage/ SCR				
kW (low/medium/high heat)	6/12/18/30				18/36/54/72				30, 45, 60, 90, 120, 150				
Gas heating performance													
Input capacity (MBh)	80/120/160				200/300/400				300, 450, 600				
Number of stages (staged option)	2				2				2 or 4 on 450 and 600				
Turndown (Modulating options)	5:1				5:1, 10:1				5:1 on 300 or 12:1				
Gas connection size (mpt)	1/2"				3/4"				3/4"				
Steady state efficiency	80%				80%				80%				
Heating coil													
Type	Hot Water				Hot Water				Hot Water				
Rows / FPI (high heat/low heat)	(2/10) / (1/8)				(2/10) / (1/8)				1/12, 2/12, 3/13				
Face area (sq ft)	2.5				5.4				12.3				
Compressors													
Quantity / Type	(1) Inverter Scroll				(1) Inverter Scroll, (1) Fixed Speed Scroll				1 Inverter Scroll on 16–20, 1 Inverter Scroll + 1 fixed speed scroll				
Number of stages	Modulating				Modulating				Modulating				
Refrigerant	R-410A				R-410A				R - 410A				
Indoor coil													
Rows / FPI	3/16	4/16	4/14	4/14	3/15	4/15	4/15	6/12	3/15	3/15	4/15	4/15	4/15
Face area (sq ft)	4.8	4.8	6.0	6.0	14.0	15.4	15.4	15.4	22.0	22.0	21.6	21.6	21.6
Capacity control	Electronic Expansion Valve (EEV)				Electronic Expansion Valve (EEV)				Electronic Expansion Valve (EEV)				
Outdoor coil													
Type: non-heat pump/heat pump[6]	Aluminum Micro-channel/Copper tube-Aluminum fin								Aluminum Micro-channel				
Rows / FPI — heat pump	2/16	2/16	3/16	3/16	3/16	4/16	4/16	4/16	—	—	—	—	—
Rows / FPI — non-heat pump	1/21	1/21	3/16	3/16	1/21	1/21	4/16	1/21	1/23				
Outdoor fan and motor													
HP / Quantity	0.5/1	0.5/1	1.0/1	1.0/1	1.0/2	1.0/2	1.0/2	1.0/2	3.5/1				
Fan Diameter (in) / Quantity	27/1	27/1	27/1	27/1	27/2	27/2	27/2	27/2	39/1				
Indoor fan													
Type	Centrifugal Airfoil (SWSI)				Centrifugal Airfoil (SWSI)				Centrifugal Airfoil (SWSI)				
Quantity / Diameter[2]	(1) 12", (1) 14", (1) 16"				(1) 14", (1) 16", (1) 22"	(1) 22"			1/16 or 1/20	1/20 or 1/24		1/24	
Quantity / Diameter[3]	(1) 12", (1) 14", (1) 16"				(1) 14", (1) 16", (1) 22"				1/16 or 1/20				
Drive type	Direct Drive				Direct Drive				Direct Drive				
Motor HP range	1.3 / 2.3 / 4.0				4.0 / 8.0				1 - 7.5		2 - 10	3 - 15	3 - 20
Hot gas reheat coil													
Coil Type	Microchannel				Microchannel				Microchannel				
Control Type	Modulating				Modulating				Modulating				
Temperature rise	20°				20°				20°				
Filters													
Type	2", 4"				2", 4"				2" (MERV8), 4" (MERV14)				
Area (sq ft)	7.1				18				27.0				
Qty. - size	4 – 16 × 16				6 – 18 × 24				9 - 18 x 24				

NOTE:
1. EER and IEER/SEER for Cooling Only VAV, 460 volt unit
2. Mixed Outside Air and Return Air units
3. 100% Outside Air unit only
4. Heat pump performance for units with back up electric heat
5. HSPF for 3-5 ton units only
6. Size 5, 6 and 12 non-heat pump models use copper tube aluminum fin

Table 3: Physical Data—Unit Weights DPS 003 through 028

Model	Small Cabinet				Medium Cabinet			
	003	004	005	006	007	010	012	015
Weight (lbs.)								
Base Weight[1]	1000	1000	1025	1058	1600	1600	1600	1763
Heat pump	1030	1030	1058	1058	1660	1660	1660	1823
Electric Heat	45	45	45	45	100	100	100	100
Hot Water 2 Row	11	11	11	16.5	30	30	30	30
Hot Water 1 Row	32	32	32	20	31	31	31	31
Gas Heat	75	75	63	93	186	186	186	186
Hot Gas Re-heat	8	8	12	12	28	31	31	31
Economizer	163	163	163	163	308	308	308	308
High capacity coil	105	105	105	105	215	215	215	215
Energy Wheel Weight Adds (lbs.)								
100% OA	160	160	160	160	300	300	300	300
Mixed Air	175	175	175	175	250	250	250	250

1. Includes standard cooling coil

Model		Large Cabinet				
		016	018	020	025	028
Base Weight (in lbs.)		2,465		2,575	2,700	
Heat Pump		—	—	—	—	—
Electric Heat		228				
Hot Water Heat	1-row	60				
	2-row	100				
	3-row	140				
Gas Heat	300	175				
	450	225				
	600	275				
Hot Gas Reheat		30				
Economizer		500				
ERW – Small		350				
ERW – Large		400				
Indoor Fan	16"	100				
	20"	150				
	24"	260				
Indoor Fan Motors	1	36				
	1.5	41				
	2	40				
	3	69				
	5	84				
	7.5	115				
	10	128				
	15	211				
	20	225				
Exhaust Fan		250				

Size 3–15 Fan Weights (lbs.)	
12 Inch (310 mm)	87
14 Inch (360 mm)	91
16 Inch (400 mm)	115
22 Inch (560 mm)	115

Curb Weights (lbs.)	14"	24"
003—006	156	230
007—015	200	295
016—028	566	657

Table 4: Refrigerant Charge

Unit Size	Cooling Model		Heat Pump Model	
	Standard Unit	Standard Unit w/ MHGRH	Standard Unit	Standard Unit w/ MHGRH
3	10.5	12.9	12.0	14.4
4	11.1	13.5	12.6	15.0
5	15.3	18.2	16.8	19.7
6	15.3	18.2	16.8	19.7
7.5	11.0	17.3	26.0	31.2
10	34.0	39.8	40.0	45.8
12	34.0	39.8	40.0	45.8
15	37.0	43.8	42.0	47.8
16	37.0	Consult Factory		
18	37.0			
20	37.0			
25	35.5			
28	35.5			

Fan Curves

Figure 19: Fan Curve – 12 inch Fan

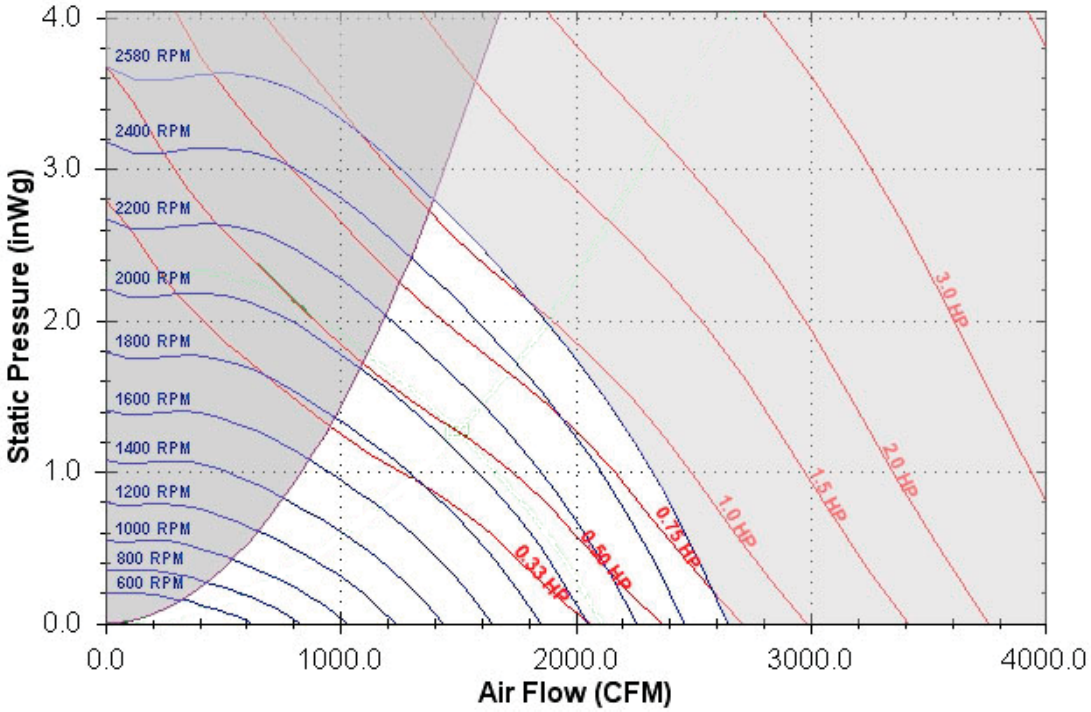


Figure 20: Fan Curve – 14 inch Fan

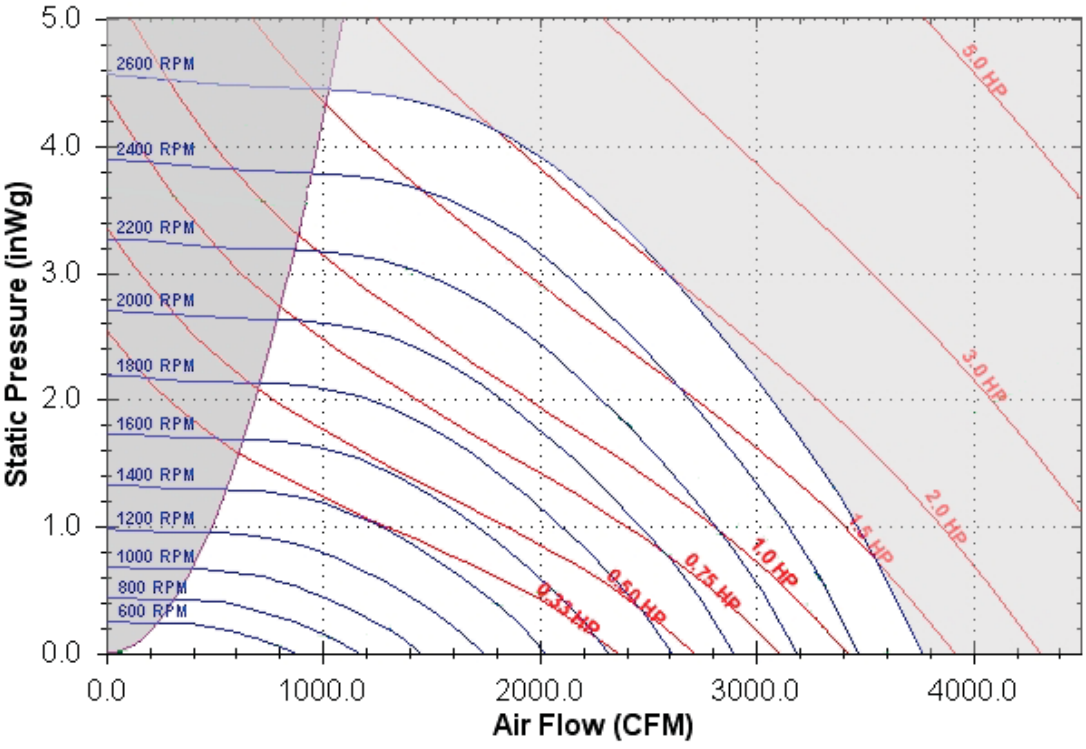


Figure 21: Fan Curve – 16 inch Fan

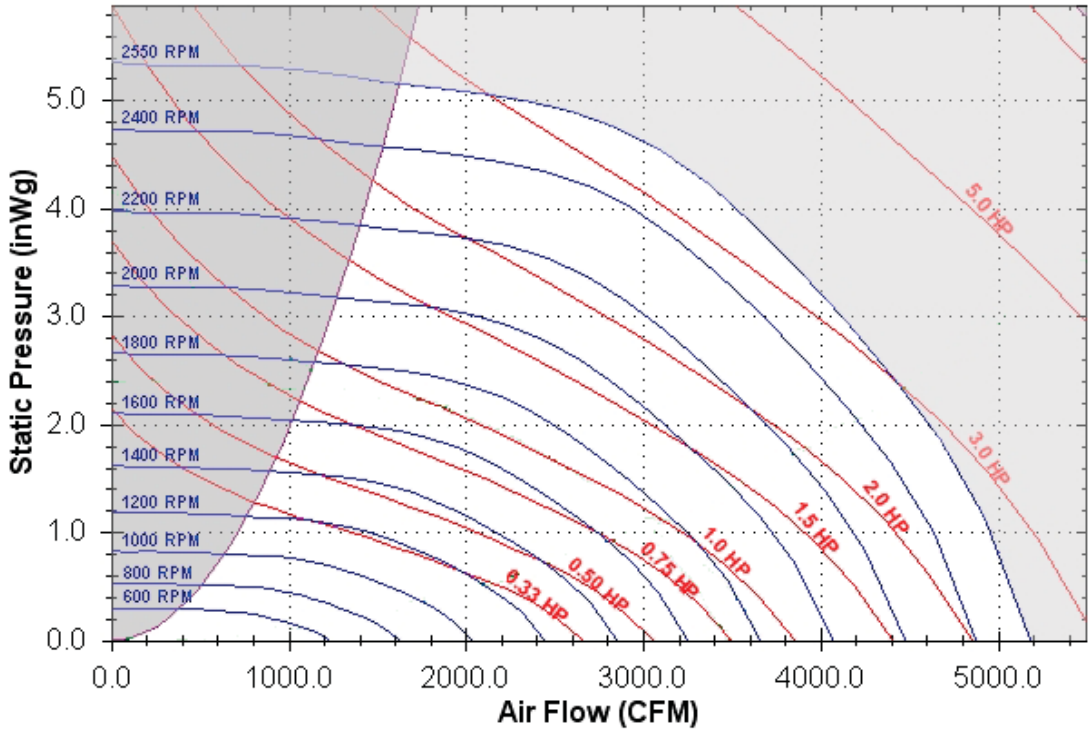


Figure 22: Fan Curve – 22 inch Fan

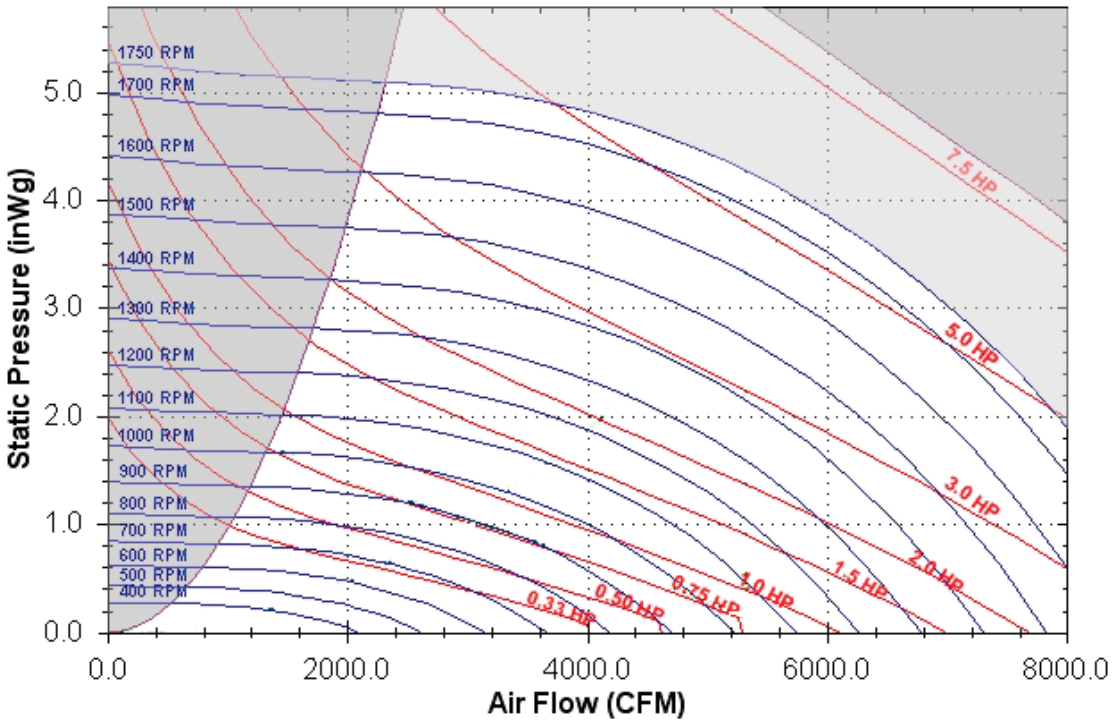


Figure 23: Fan Curve – DDPL-16 – Size 16–28

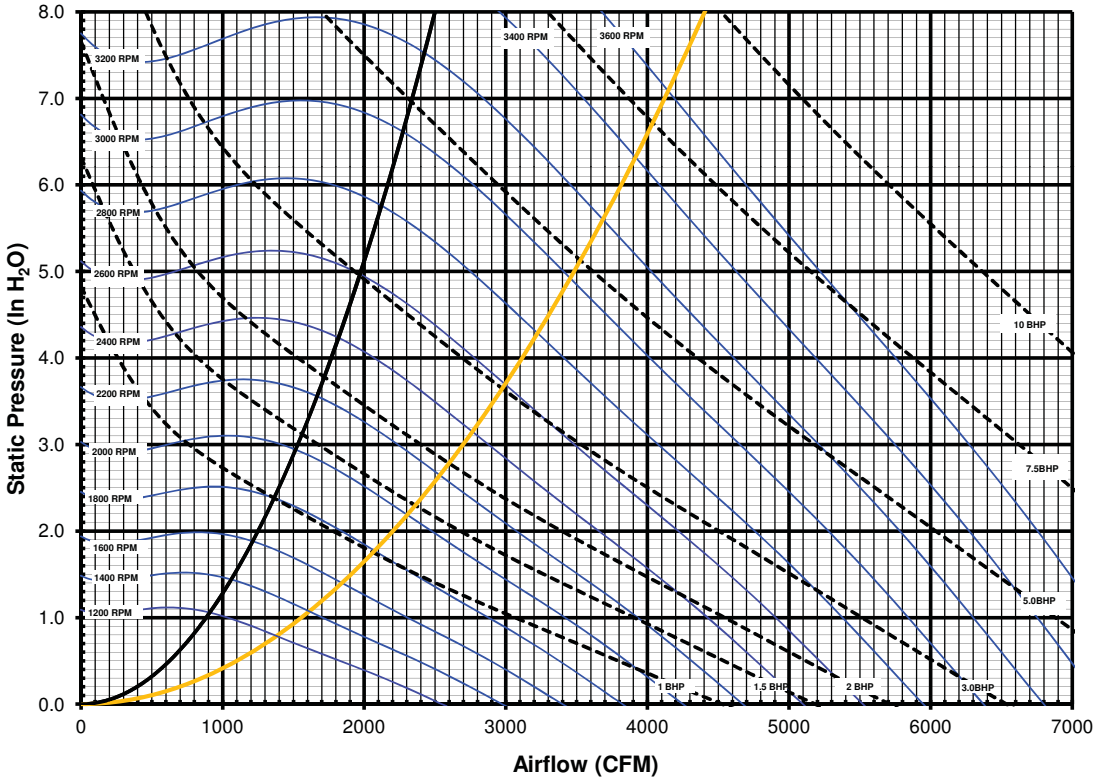


Figure 24: Fan Curve – DDPL-20 – Size 16–28

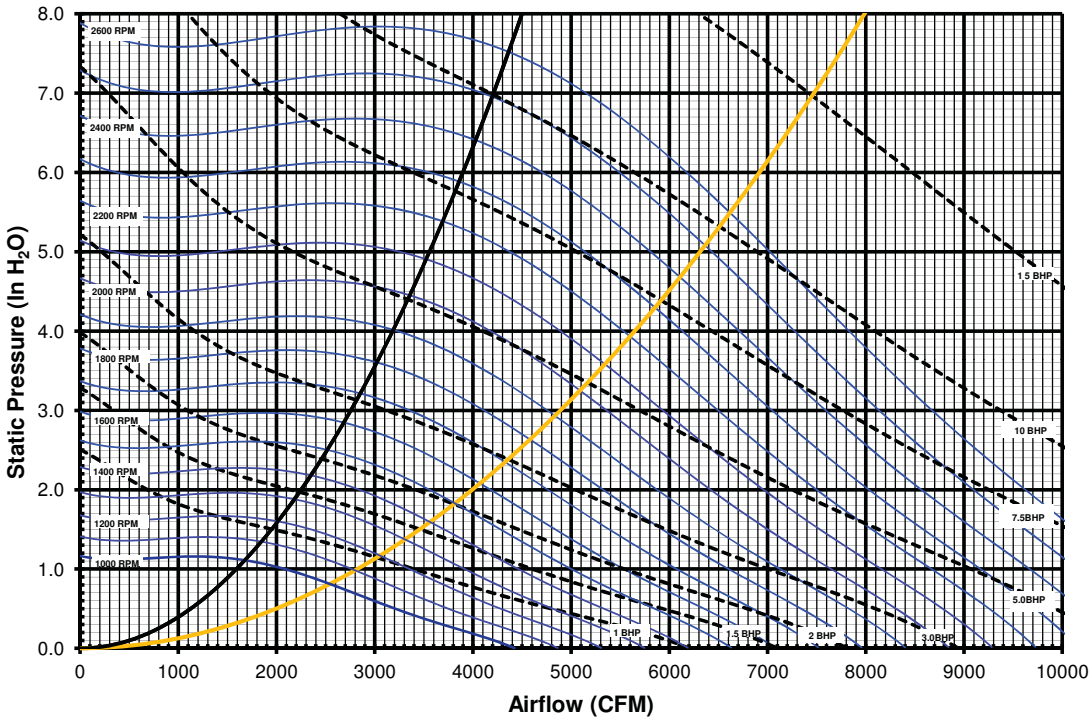
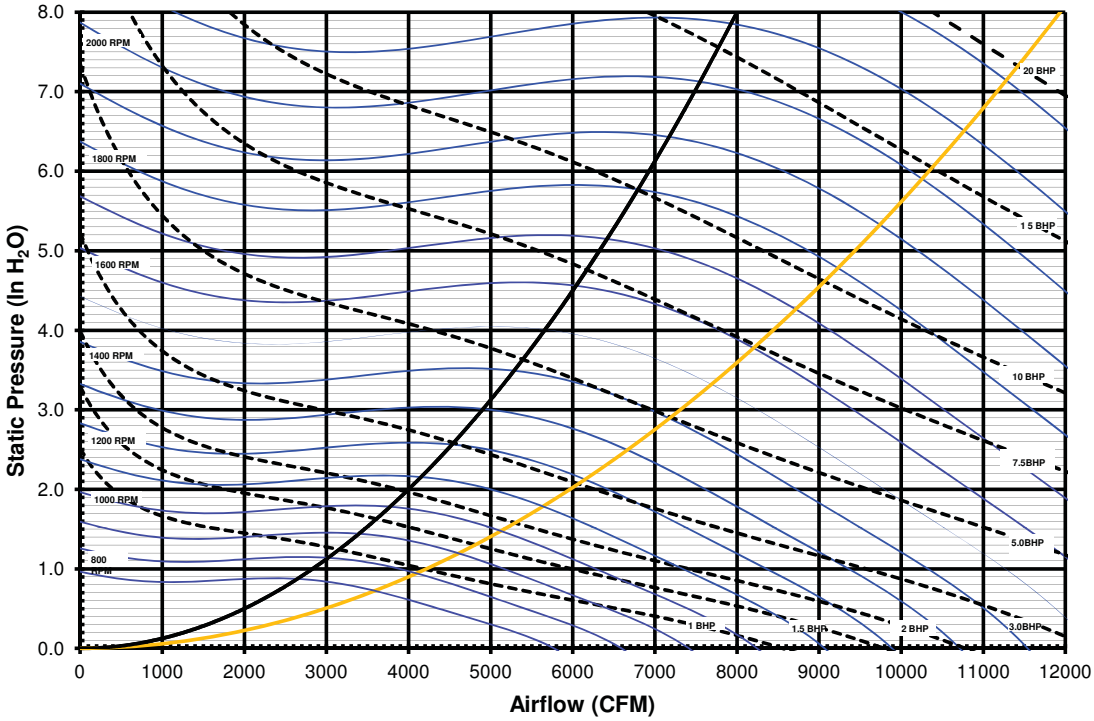


Figure 25: Fan Curve – DDPL-24 – Size 16–28



Heating Capacity

Table 5: Heating Capacity – Electric Heaters

Unit	Stages	Option # 1				Option # 2				Option # 3				Option # 4				Option # 5				Option # 6			
		KW	MBH	Delta T[1]	Min (cfm)	KW	MBH	Delta T[1]	Min (cfm)	KW	MBH	Delta T[1]	Min (cfm)	KW	MBH	Delta T[1]	Min (cfm)	KW	MBH	Delta T[1]	Min (cfm)	KW	MBH	Delta T[1]	Min (cfm)
003	2, SCR	6	20.5	15.8	316	12	40.9	31.6	632	18	61.4	47.4	948	30	102.4	60.0[3]	1580	—	—	—	—	—	—	—	—
004				11.9				23.7				35.6				59.3		—	—	—	—	—	—	—	—
005				9.5				19.0				28.4				47.4		—	—	—	—	—	—	—	—
006				7.9				15.8				23.7				39.5		—	—	—	—	—	—	—	—
007	4, SCR	18	61.4	19.0	948	36	122.9	37.9	1896	54	184.3	56.9	2844	72.0[2]	245.8	60.0[3]	3793	—	—	—	—	—	—	—	—
010				14.2				28.4				42.7				56.9		—	—	—	—	—	—	—	—
012				11.9				23.7				35.6				47.4		—	—	—	—	—	—	—	—
015				9.5				19.0				28.4				37.9		—	—	—	—	—	—	—	—
016		30	102	17.5	1580	45	154	26.2	2369	60	205	34.9	3159	90	307	52.4	4739	—	—	—	—	—	—	—	—
018																									
020				13.5				20.3				27.1				40.6				54.2		—	—	—	—
025				10.8				16.2				21.7				32.5		120	409	43.3	6319	150	512	54.2	7898
028				9.8				14.8				19.7				29.5				39.4				49.2	

1. Temperature is calculated at nominal air flow
2. Not available in 208 & 230 Volt
3. 60 degree max rise

Table 6: Heating Capacity and Water Pressure Drop – Hot Water Coils

Unit	MBH	GPM	WPD	Connection Size
3	61.4	6.1	1.0	1.375 Sweat
4	72.9	7.3	1.4	1.375 Sweat
5	82.6	8.2	1.7	1.375 Sweat
6	91.6	9.2	2.2	1.375 Sweat
7.5	149.7	15.0	3.1	1.375 Sweat
10	176.9	17.8	4.2	1.375 Sweat
12	195.9	19.6	5.1	1.375 Sweat
15	221.4	22.1	6.4	1.375 Sweat
16	347	35.5	0.7	1.375 Sweat
18	376	38.4	1.2	1.375 Sweat
20	403	41.1	1.3	1.375 Sweat
25	464	47.3	1.4	1.375 Sweat
28	497	50.7	1.6	1.375 Sweat

Nominal airflow, 60°EAT, approximately 180°–160° water. WPD does not include a field supplied valve pressure drop. 2-row performance shown, 1-row coil also available.

Table 7: Heating Capacity – Gas Furnaces

Data	Unit Size								
	003–006			007–015			016–028		
	Low Heat	Med Heat	High Heat	Low Heat	Med Heat	High Heat	Low Heat	Med Heat	High Heat
Heating Input	50	100	150	200	300	400	300	450	600
Heating Output	40	80	120	160	240	320	240	360	480
Steady State Efficiency	80%								
Number of Stages	2						2	4	
Turndown[1]	5:1			5:1 or 10.1			5:1	12:1	

1. Modulating Heat Only

Air Pressure Drops

Table 8: Pressure Drop – Electric Heaters

Unit	Unit Airflow					
	1000	2000	3000	4000	5000	6000
003–006	0.11	0.36	0.77	—	—	—
007–015	0.02	0.07	0.14	0.23	0.34	0.48

Table 9: Pressure Drop – Hot Water Coils

Unit	Heat Type	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
003–006	Low (1 Row)	0.04	0.15	0.32	—	—	—	—	—
	High (2 Row)	0.11	0.37	0.83	—	—	—	—	—
007–015	Low (1 Row)	—	0.05	0.10	0.17	0.26	0.37	—	—
	High (2 Row)	—	0.11	0.23	0.39	0.59	0.83	—	—
016–028	Low (1 Row)	—	—	—	0.09	—	0.17	0.27	0.42
	Medium (2 Row)	—	—	—	0.16	—	0.31	0.51	0.74
	High (3 Row)	—	—	—	0.25	—	0.50	0.80	1.16

Table 10: Pressure Drop – Gas Furnaces

Unit	Heat Type	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
003–006	Low (50 MBH)	0.08	0.33	0.74	—	—	—	—	—
	Medium (100 MBH)								
	High (150 MBH)								
007–015	Low (200 MBH)	0.02	0.07	0.14	0.23	0.35	0.49	—	—
	Medium (300 MBH)								
	High (400 MBH)								
016–028	600 MBH	—	—	—	0.10	—	0.23	0.42	0.65

Table 11: Pressure Drop – Components

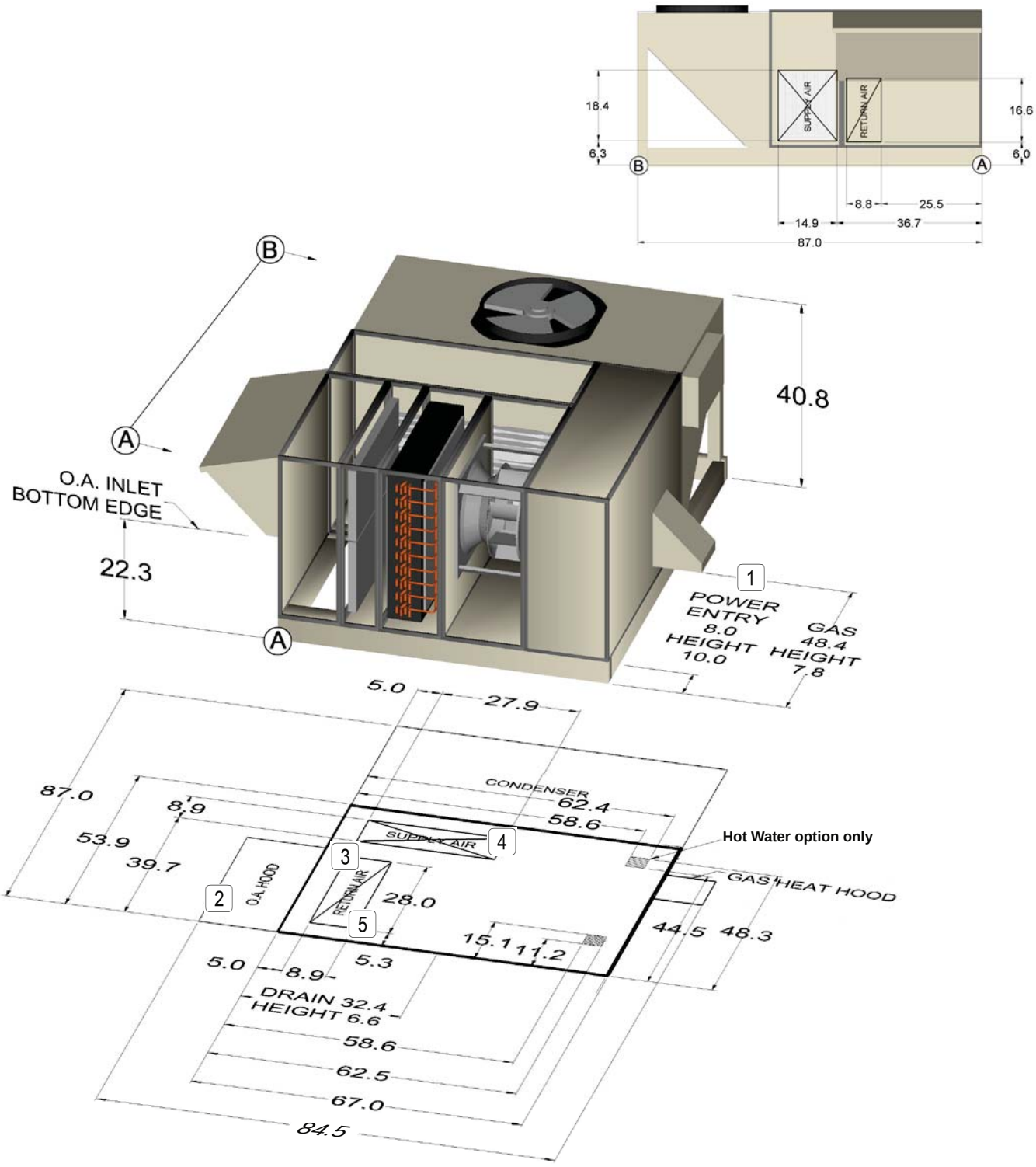
Component	Unit	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
Economizer									
	003–006	0.01	0.05	0.11	—	—	—	—	—
	007–015	0.01	0.03	0.08	0.13	0.20	0.29	—	—
	016–028	—	0.02	—	0.08	—	0.18	0.31	0.49
Filter									
	003–006	0.03	0.12	0.28	—	—	—	—	—
	007–015	0.01	0.02	0.06	0.09	0.15	0.22	—	—
2" MERV 8 (27 ft²)	016–028	—	0.02	—	0.05	—	0.09	0.13	0.18
4" MERV 14 (27 ft²)		—	0.05	—	0.11	—	0.19	0.27	0.38
Standard Cooling Coil									
	003–006	0.18	0.46	0.79	—	—	—	—	—
	007	0.03	0.09	0.14	0.20	0.25	0.33	—	—
	010–015	0.04	0.10	0.18	0.26	0.34	0.43	—	—
Hot Gas Reheat									
	003–006	0.03	0.07	0.13	—	—	—	—	—
	007–010	—	0.02	0.04	0.06	0.08	0.11	—	—
	015	—	0.02	0.03	0.05	0.07	0.09	—	—
	016–028	—	0.01	—	0.17	0.22	0.29	0.41	0.58

Table 12: Pressure Drop — Energy Recovery Wheel

	Airflow (CFM)														
	500	750	1000	1250	1500	2000	2500	2800	3000	3500	4000	4500	5000	5500	6500
3 – 6 Tons															
Low Airflow Wheel and Prefilters	0.40	0.58	0.77	0.96	1.12	—	—	—	—	—	—	—	—	—	—
7.5 – 15 Tons															
Low Airflow Wheel and Prefilters	—	—	0.51	—	0.75	0.99	1.22	1.35	—	—	—	—	—	—	—
High Airflow Wheel and Prefilters	—	—	N/A	—	0.38	0.49	0.61	0.68	0.73	0.84	0.96	1.08	1.19	—	—
16 – 28 Tons															
Small Wheel	—	—	—	—	0.52	—	0.88	—	—	1.26	—	—	—	—	—
Large Wheel	—	—	—	—	0.30	—	0.50	—	—	0.71	—	0.92	—	1.14	1.35

Figure 26: DPS 003–006, No Energy Recovery, 0–30% or 100% Outdoor Air

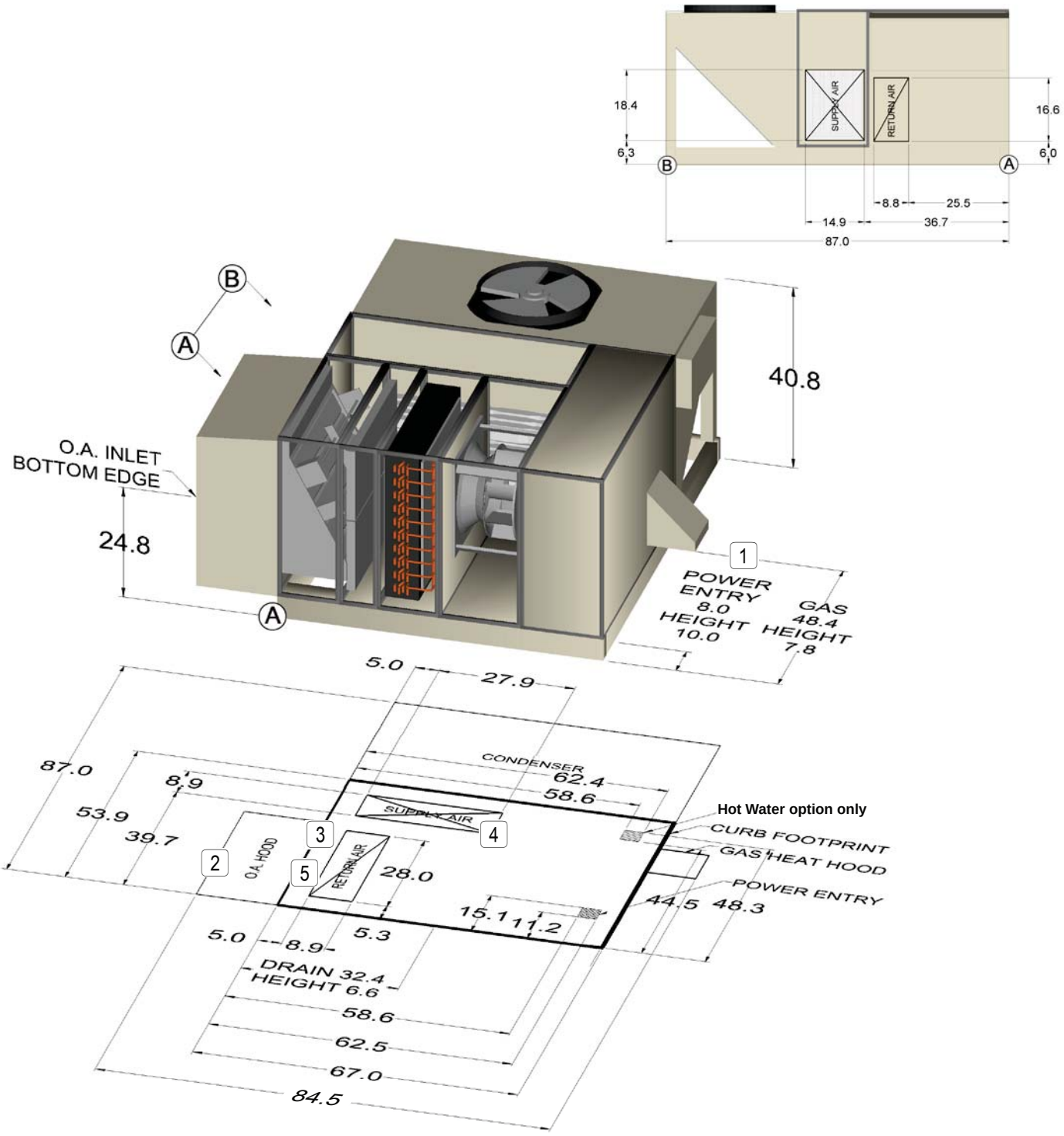
Detail: A-B for Horizontal Supply and Return Air Openings



NOTE: Horizontal above the roof gas connection only

1. Recommended location for field cut side power connection
2. Not provided on 100% Return Air units
3. Not provided on 100% Outdoor Air units
4. Not provided on units with Horizontal Supply Air opening
5. Not provided on units with Horizontal Return Air opening

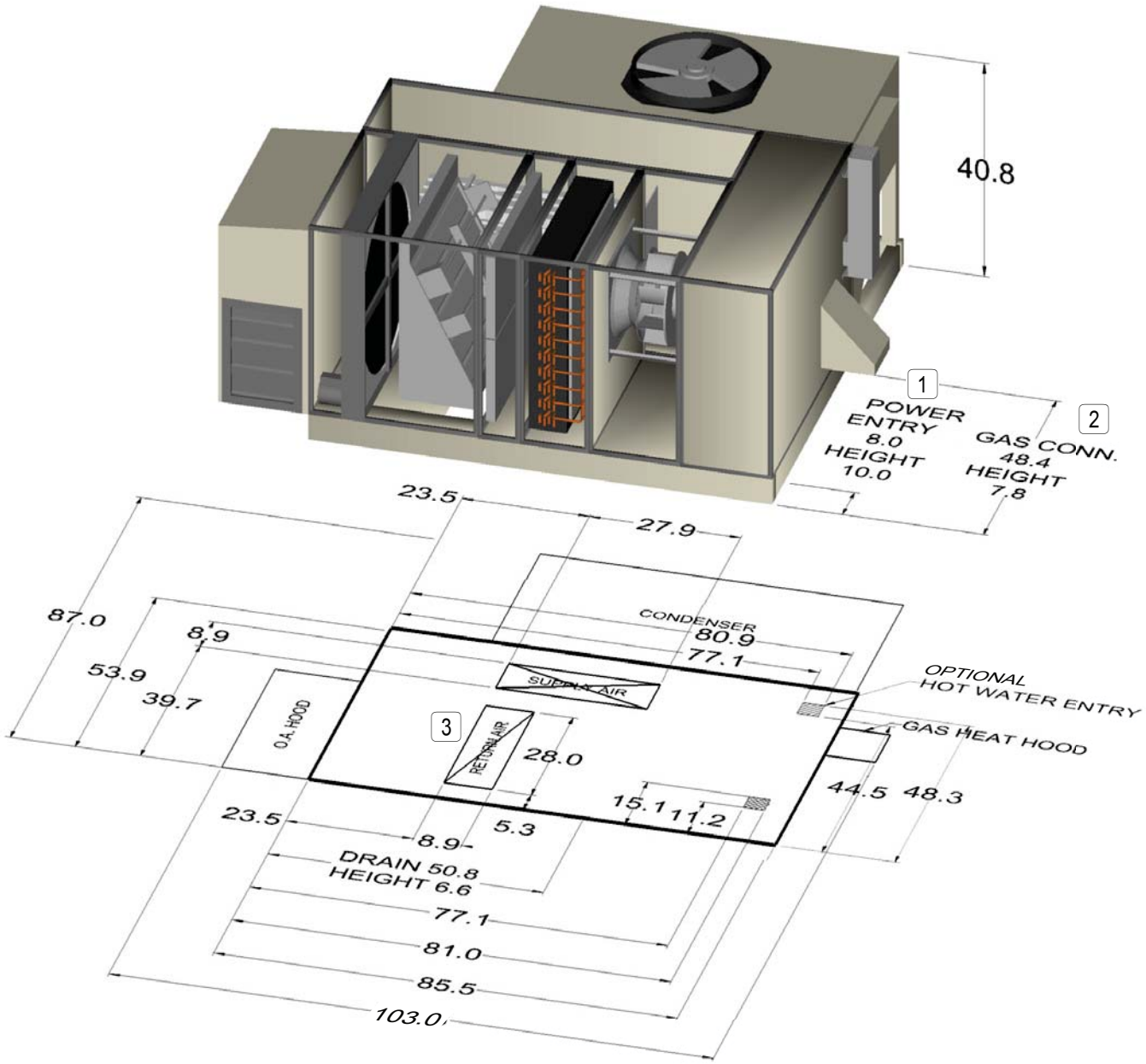
Figure 27: DPS 003–006, Economizer, No Energy Recovery



NOTE: Horizontal above the roof gas connection only

1. Recommended location for field cut side power connection
2. Not provided on 100% Return Air units
3. Not provided on 100% Outdoor Air units
4. Not provided on units with Horizontal Supply Air opening
5. Not provided on units with Horizontal Return Air opening

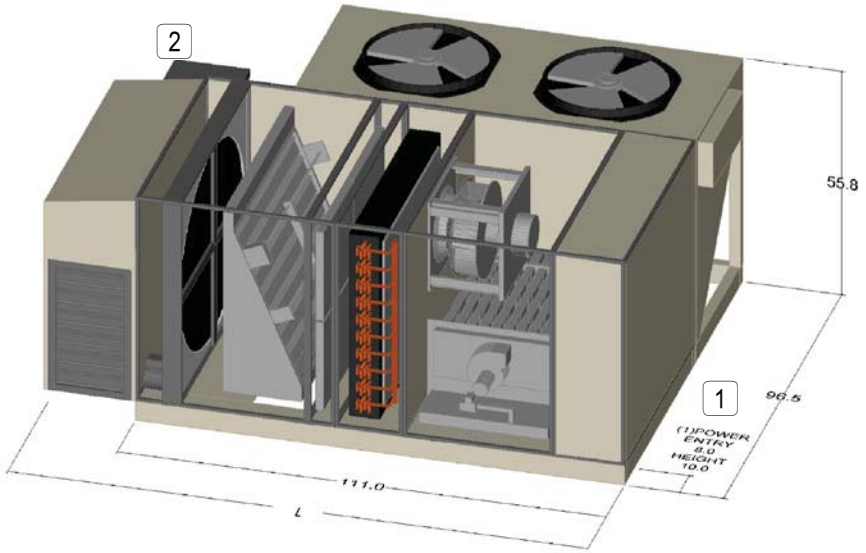
Figure 28: DPS 003–006, Energy Recovery, All Outdoor Air Options

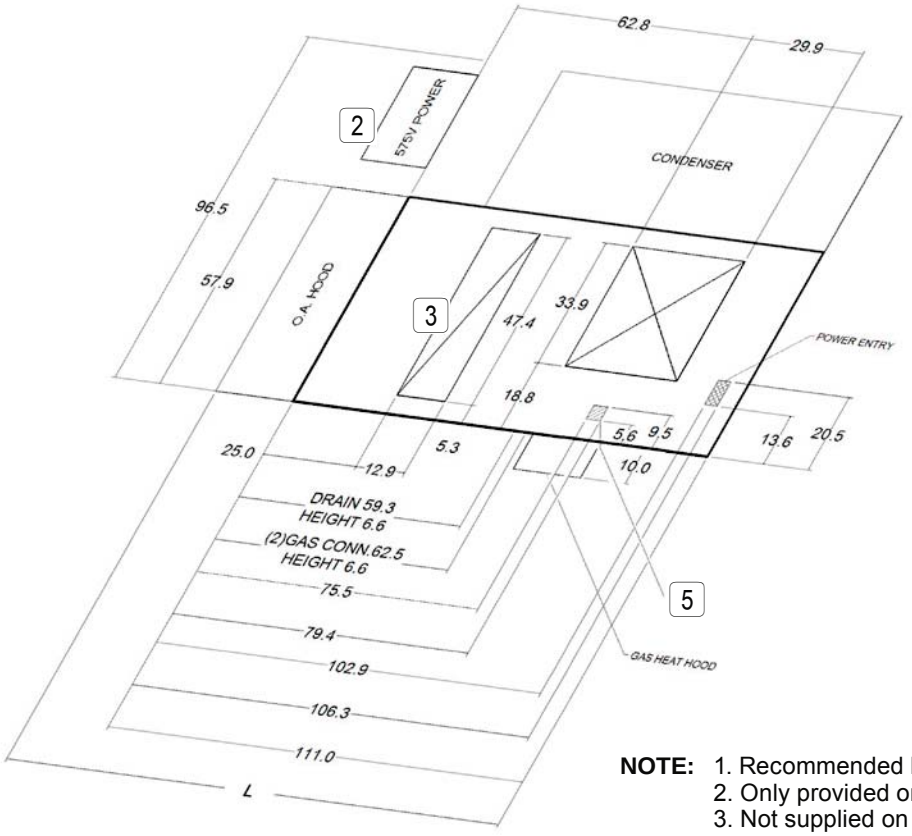


NOTE: 1. Recommended location for field cut side power connection
2. Horizontal gas connection only. Gas pipe routing within roof curb is not available
3. Not supplied on 100% OA units

Figure 29: DPS 007–015, Energy Recovery, All Outdoor Air Options

Size (tons)	L
7–12	132.7
15	149.7

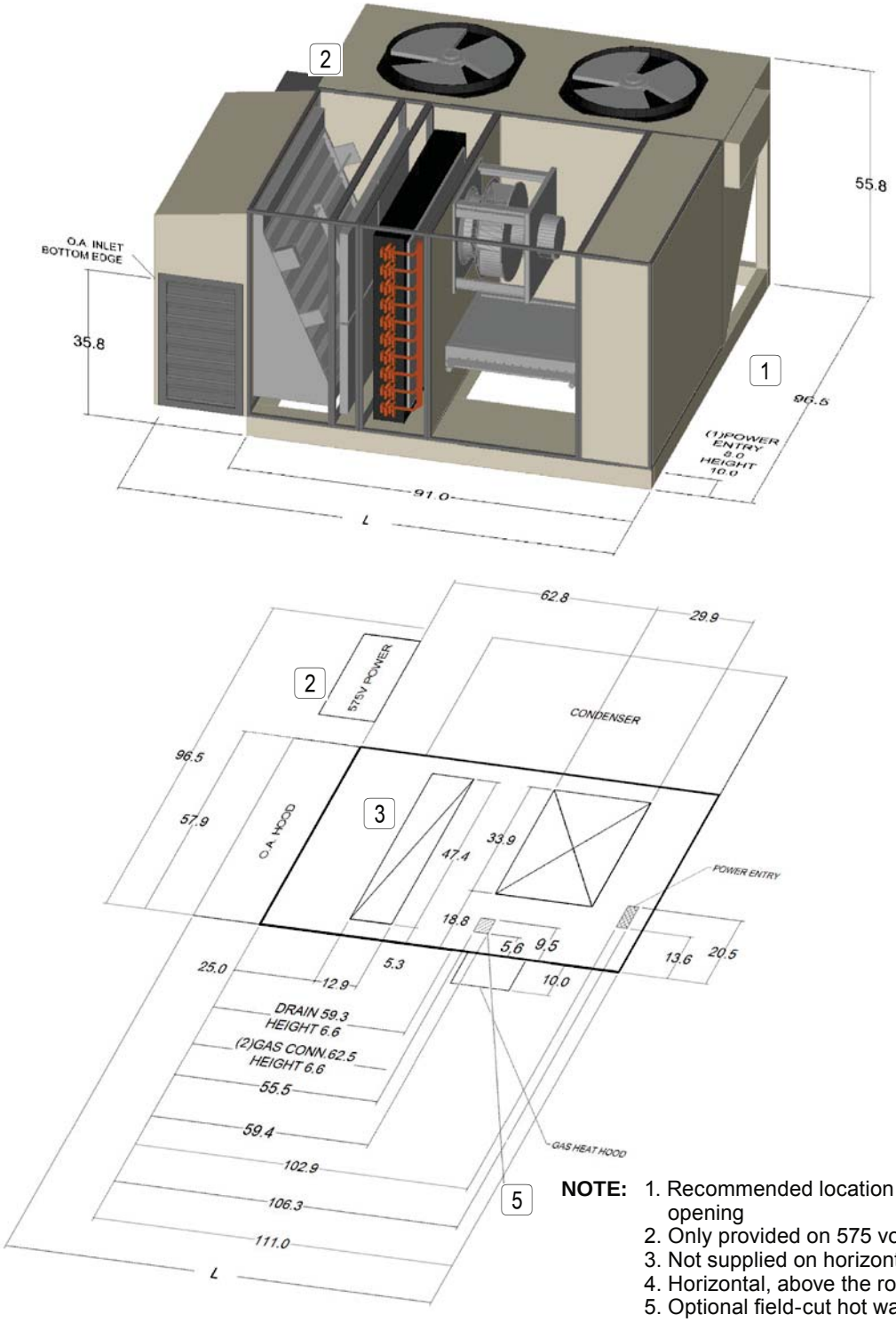




NOTE: 1. Recommended location for field-cut,side power opening
2. Only provided on 575 volt units
3. Not supplied on horizontal return or 100% OA units
4. Horizontal, above the roof, gas connection only
5. Optional field-cut hot water piping entrance

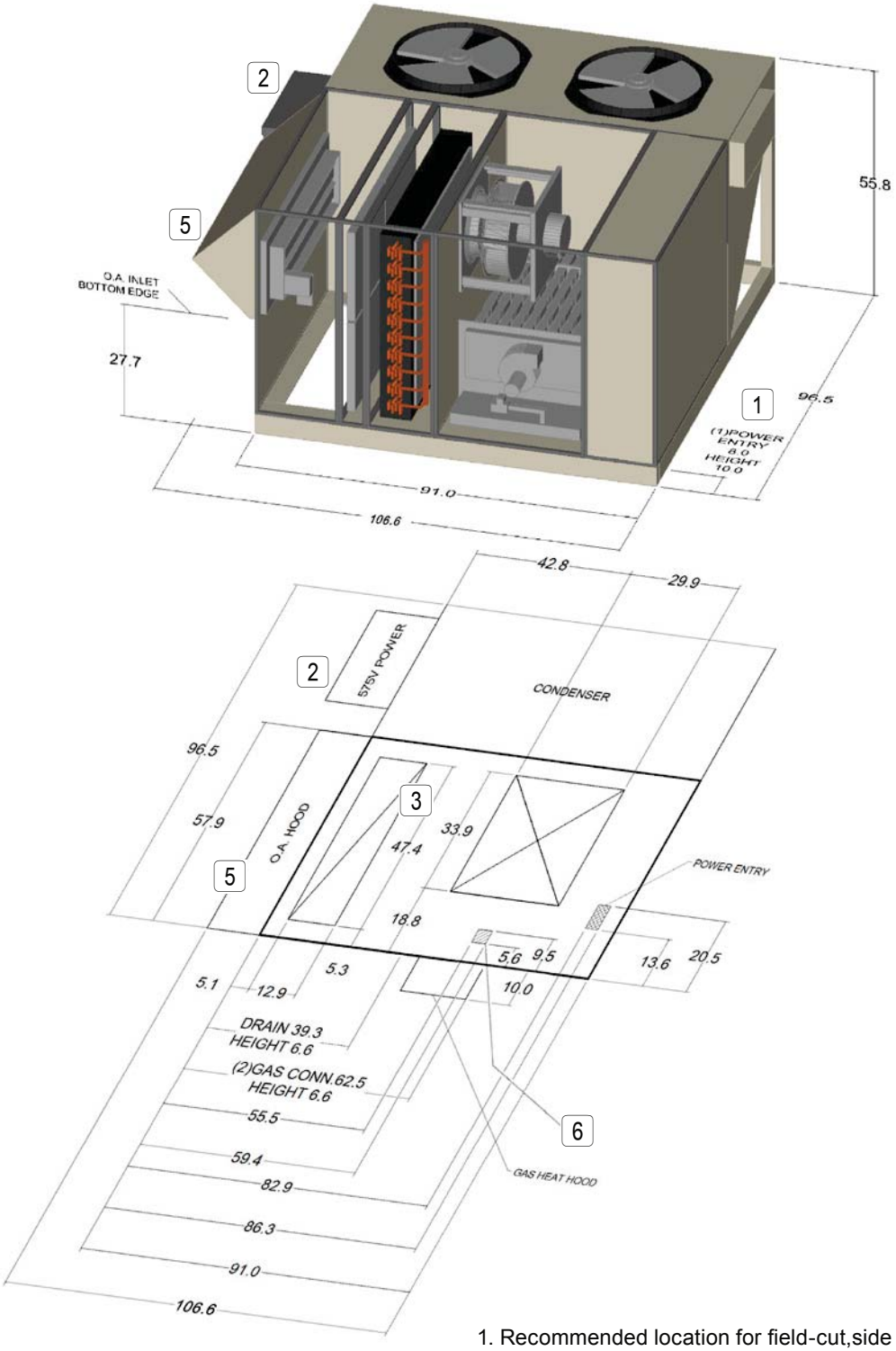
Figure 30: DPS 007–015, Economizer, No Energy Recovery

Size (tons)	L
7–12	112.7
15	129.7



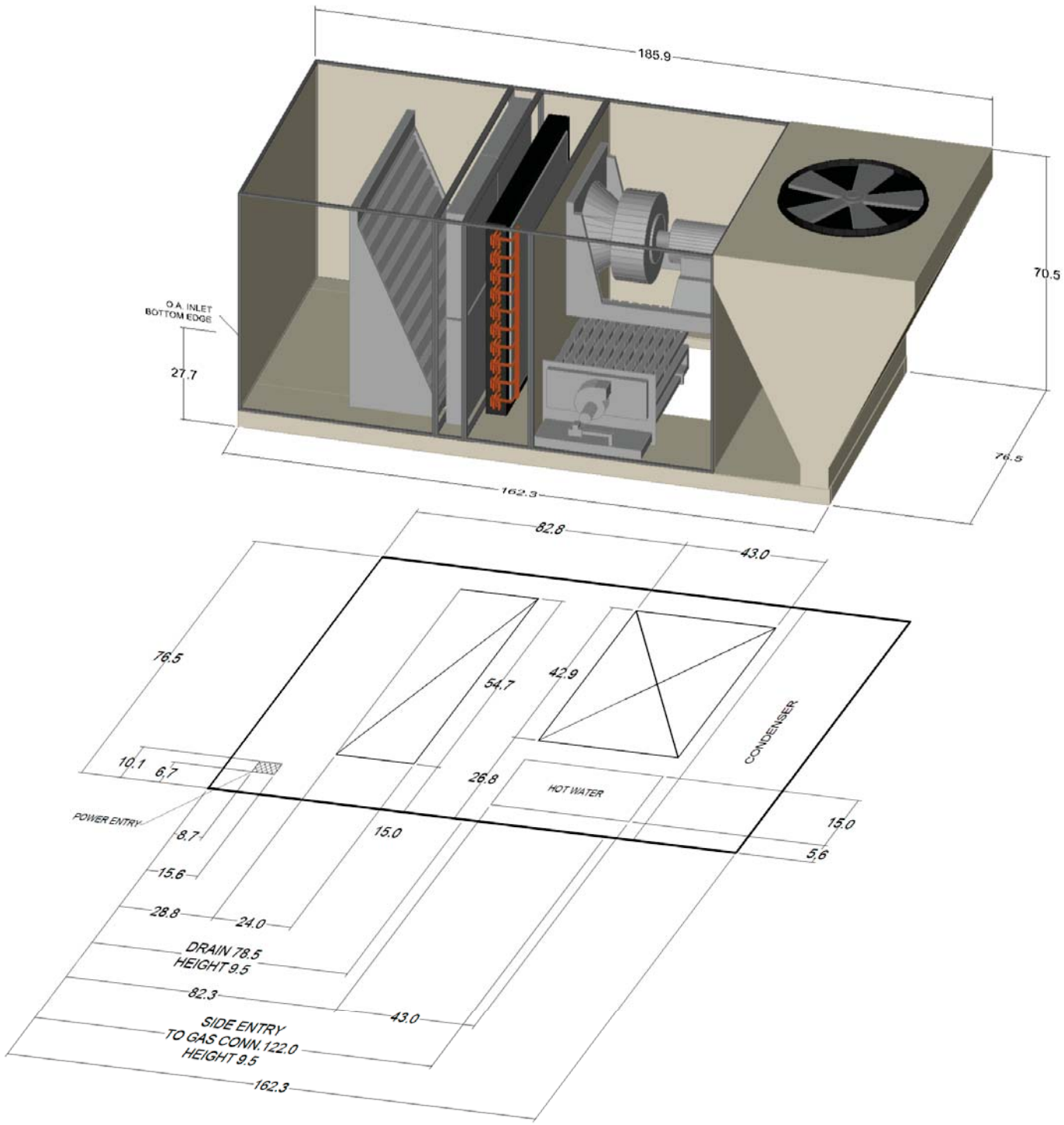
NOTE:
1. Recommended location for field-cut,side power opening
2. Only provided on 575 volt units
3. Not supplied on horizontal return units
4. Horizontal, above the roof, gas connection only
5. Optional field-cut hot water piping entrance

Figure 31: DPS 007–015, No Energy Recovery, 0–30% or 100% Outdoor Air



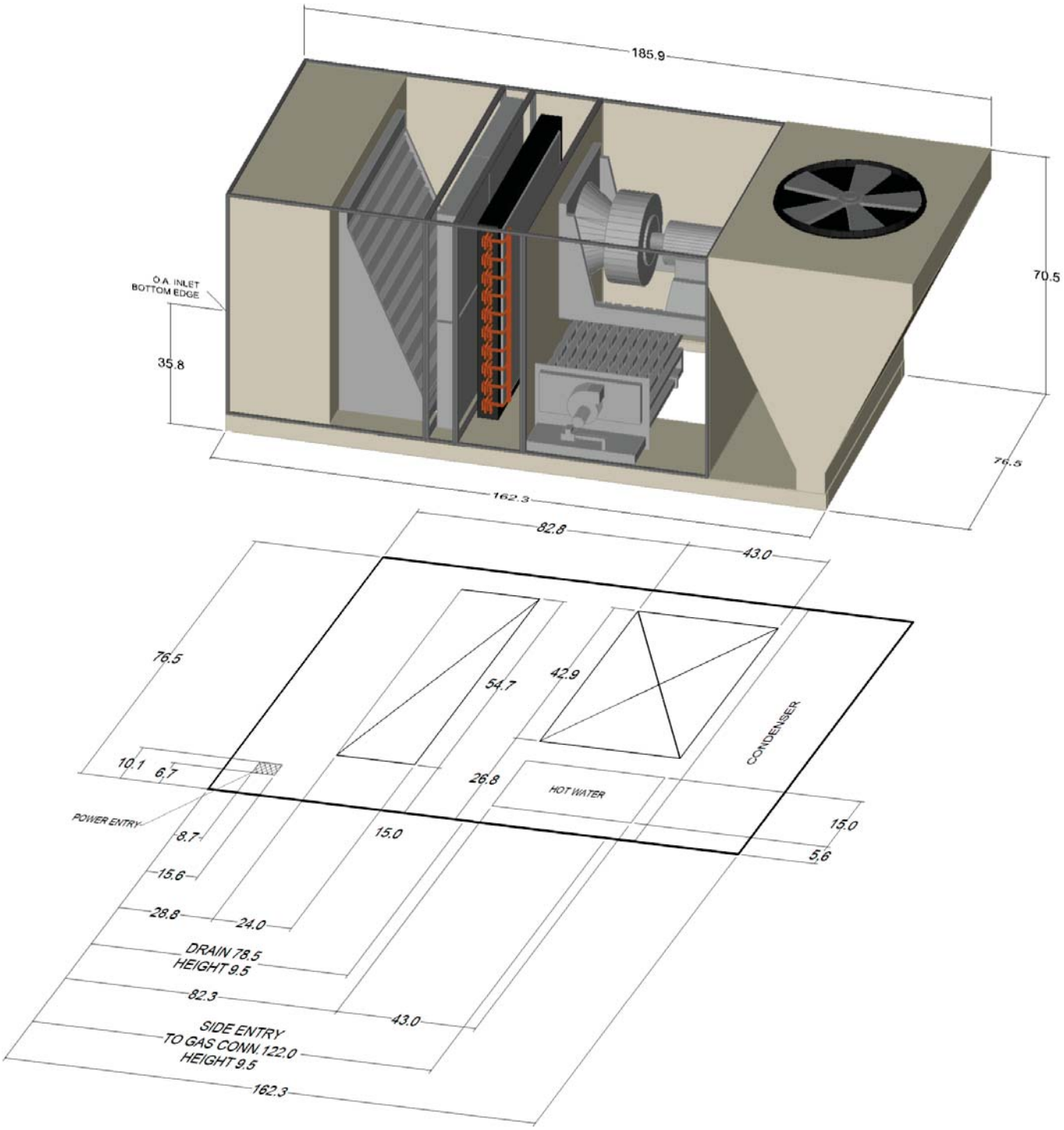
1. Recommended location for field-cut,side power opening
2. Only provided on 575 volt units
3. Not supplied on horizontal return or 100% OA units
4. Horizontal, above the roof, gas connection only
5. Not provided on 100% Return Air units
6. Optional field-cut hot water piping entrance

Figure 32: DPS 016–028, 30% or 100% Outdoor Air, No Energy Recovery



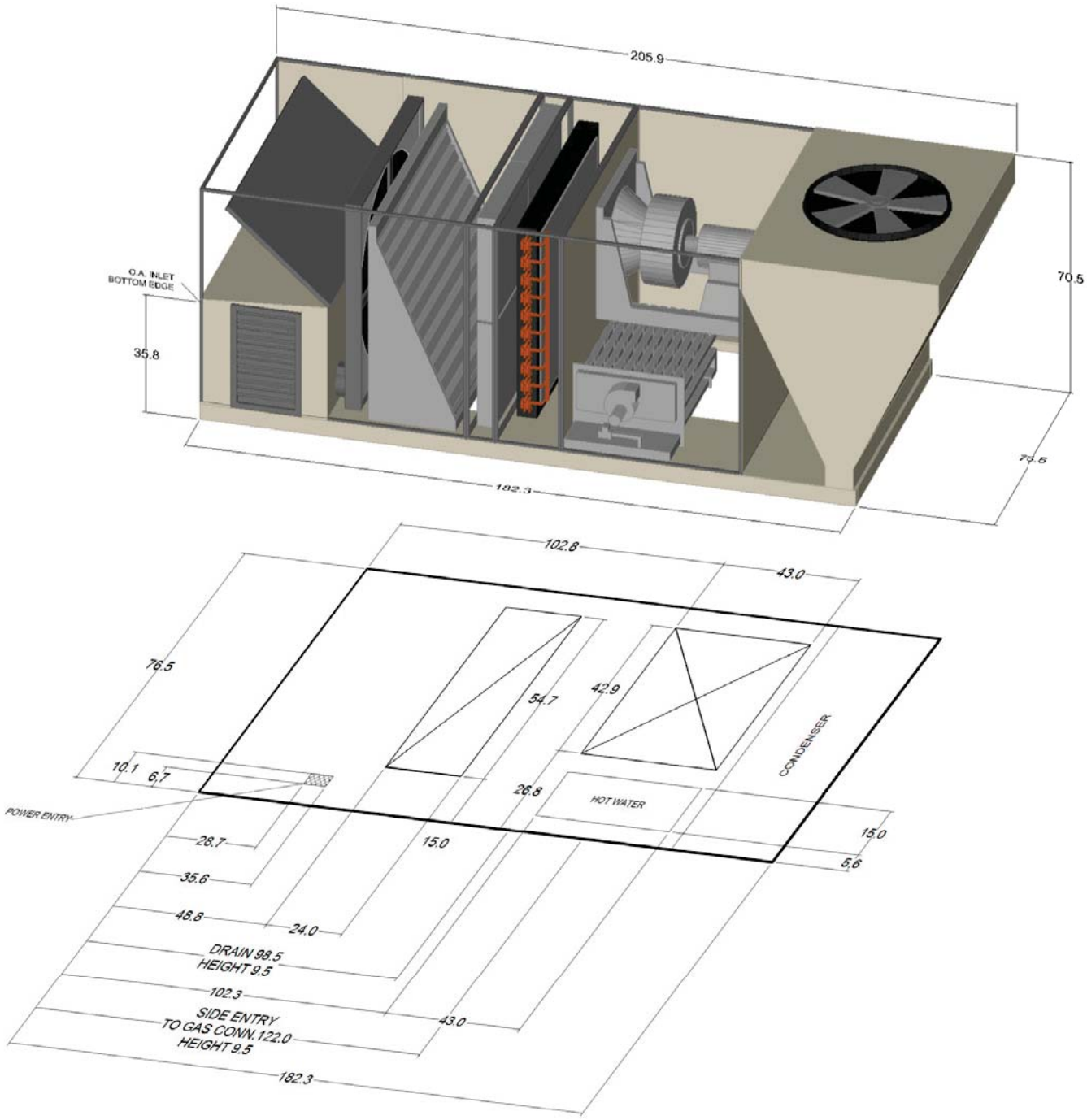
NOTE:
1. Recommended location for optional field-cut side power connection.

Figure 33: DPS 016–028, Economizer No Energy Recovery



NOTE:
1. Recommended location for optional field-cut side power connection.
2. Horizontal gas connection only. Gas pipe routing within the roof curb is not available.

Figure 34: DPS 016–028, Energy Recovery



NOTE:
1. Recommended location for optional field-cut side power connection.
2. Horizontal gas connection only. Gas pipe routing within the roof curb is not available.

Table 13: DPS 003–015 Electric Heat Data[1]

kW	Voltage	Amps
6	208	16.7
	230	15.1
	475	7.3
	575	6.0
12	208	33.3
	230	30.1
	475	14.6
	575	12.0
18	208	50.0
	230	45.2
	475	21.9
	575	18.1
30	208	83.3
	230	75.3
	475	36.5
	575	30.1
36	208	99.9
	230	90.4
	475	43.8
	575	36.1
54	208	149.9
	230	135.6
	475	65.6
	575	54.2
72	—	—
	—	—
	475	87.5
	575	72.3

1. Maximum temperature rise equals 60ºF

Table 14: DPS 016–028 Electric Heat Data

KW	Voltage	Amps
30	208	83.4
	230	75.4
	460	37.7
	575	30.2
45	208	125.1
	230	113.1
	460	56.5
	575	45.2
60	208	166.7
	230	150.8
	460	75.4
	575	60.3

KW	Voltage	Amps
90	208	250.1
	230	226.2
	460	113.1
	575	90.5
120	208	333.5
	230	301.6
	460	150.8
	575	120.6
150	208	416.9
	230	377.0
	460	188.5
	575	150.8

Rebel Minimum Circuit Ampacity [MCA] or Wire Sizing Amps

No electric heat

MCA = 1.25 × largest motor FRLA + sum of all other motor FRLA

Heat Pump with electric heat where electric heat > 50 kW

MCA = 1.25 × largest motor FRLA + sum of all other motor FRLA + heater FLA

Heat Pump with electric heat where electric heat is less than or equal to 50 kW

MCA = 1.25 × [heater FLA + largest motor FRLA] + sum of all other motor FRLA

Not a heat pump with electric heat

Must calculate heat mode MCA and cool mode MCA and use the greater value.
Do not include compressors or condenser fans in the heat mode MCA.

Cooling mode MCA = 1.25 × largest motor FRLA + sum of all other motor FRLA

Heating mode MCA where electric heat > 50 kW

MCA = 1.25 × largest motor FLA + sum of all other motor FLA + heater FLA

Heating mode MCA where electric heat is less than or equal to 50 kW

1.25 × [heater FLA + largest motor FLA] + sum of all other motor FLA

NOTE: FRLA = fan motor or controls full load amps or compressor rated load amps
FLA = fan motor or electric heat or controls full load amps
Control amps are:

Voltage	208	230	460	575
Gas Heat Units	2.36	2.16	1.08	0.86
All Other Units	1.18	1.08	0.54	0.43

Table 15: Amp Draw Data

Unit Size (Tons)	Compressor RLA									Compressor LRA								Condenser Fan FLA Each			
	Compressor 1 - Variable					Compressor 2 - Fixed				Compressor 1				Compressor 2							
	Voltage					Voltage				Voltage				Voltage				Qty	208	230	460
	208	230	460	575	[%]	208	230	460	575	208	230	460	575	208	230	460	575				
3	7.7	7.0	3.5	—	45%	0.0	0.0	0.0	—	See Note				0.0	0.0	0.0	—	1	0.9	0.8	0.4
4	10.0	9.0	4.5	—	55%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	0.9	0.8	0.4
5	11.9	10.8	5.4	—	68%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	2.0	1.8	0.9
6	15.0	13.6	6.8	—	89%	0.0	0.0	0.0	—					0.0	0.0	0.0	—	1	2.0	1.8	0.9
7.5	11.9	10.8	5.4	—	68%	8.6	7.8	3.9	—					67.5	73.7	37.1	—	2	2.0	1.8	0.9
10	10.0	9.0	4.5	—	59%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
12	15.0	13.6	6.8	—	89%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
15	28.3	25.6	12.8	—	100%	17.5	15.8	7.9	—					93.1	84.2	42.1	—	2	2.0	1.8	0.9
16	47.0	42.5	22.9	20.5	—	0	0	0	0					See Note				1	8.0	8.0	4.0
18	47.0	42.5	22.9	20.5	—	0	0	0	0									1	8.0	8.0	4.0
20	47.0	42.5	22.9	20.5	—	0	0	0	0									1	8.0	8.0	4.0
25	47.0	42.5	22.9	20.5	—	39.1	35.4	18.6	15.4									1	8.0	8.0	4.0
28	47.0	42.5	22.9	20.5	—	39.1	35.4	18.6	15.4									1	8.0	8.0	4.0

NOTE: The inverter compresor is controlled to have a soft start and an LRA <1.0

Horse Power	Supply Fan FLA				Exhaust Fan FLA			
	Voltage				Voltage			
	208	230	460	kW	208	230	460	kW
1.3	3.1	2.8	1.4	1.0	3.1	2.8	1.4	1.0
2.3	5	4.6	2.3	1.7	5	4.6	2.3	1.7
4	8.8	7.4	4.0	3.0	8.8	7.4	4.0	3.0
8	13.5	12.2	6.1	6.0	—	—	—	—

575V Amp Draws: Compressors and motors will be run off a 575 to 460V transformer. Motors will be nameplated at 460V. 575 voltage is for large cabinet only.

Table 16: Recommended Field Power Wiring

Ampacity (MCA)	Number of Power Wires Per Phase	Wire Gauge	Insulation Temperature Rating (°C)
20	—	14	75
25	1	12	75
35	1	10	75
50	1	8	75
65	1	6	75
85	1	4	75
100	1	3	75
115	1	2	75
130	1	1	75
150	1	1/0	75
175	1	2/0	75
200	1	3/0	75
230	1	4/0	75
255	1	250	75

1. All wire sizes assume separate conduit for each set of parallel conductors.
2. All wire sizes based on NEC Table 310-16 for 75°C THW wire (copper). Canadian electrical code wire ampacities may vary.
3. All wire sizes assume no voltage drop for short power leads.

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Packaged Rooftop air conditioners

1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

D. AHRI 340/360 - Unitary Large Equipment

E. NEMA MG1—Motors and Generators

F. National Electrical Code.

G. NFPA 70—National Fire Protection Agency.

H. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

I. UL 900—Test Performance of Air Filter Units.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTANENCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Daikin Applied

1. No equal exists. [Deducts for alternative equipment will be considered.]

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single zone Heating and Cooling Unit(s) model DPS. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Gas heating section.
6. Condensing unit section

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2013 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" [size 3-15] 2" [size 16-28] thick with an R-value of 7 [size 3-15] 13 [size 16-28,], and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished panel surfaces to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 ECONOMIZER SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

B. Provide factory installed and tested, outdoor air monitor that controls outdoor air +/- 15% accuracy down to 40 cfm per ton.

C. Economizer assembly shall be California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with Title 24 specifications.

2.05 EXHAUST FAN

A. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

C. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.06 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

F. A drain pan over flow safety shall shut off the unit and issue a warning before over flow occurs.

2.07 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. All fan assemblies shall employ solid steel fan shafts. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

D. Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.

E. Size 3-15 - The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures.

F. Size 16-28 - the motor shall be T Frame and open drip proof. Ovrload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

G. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.08 VARIABLE AIR VOLUME CONTROL

A. Size 3-15 Multiple Zone VAV–The unit controller shall proportionally control the Electronically Commutated Motors (ECM) on the supply and exhaust fans. The supply fan shall be controlled to maintain an adjustable duct pressure setpoint. A duct static pressure sensor shall be factory mounted in the control panel. The field shall furnish and install the pneumatic tubing for the duct static pressure sensor and the building pressure sensor. The field shall furnish and install the outdoor air pressure sensor.

B. Size 3-15 Single Zone VAV–The unit controller shall proportional control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

C. Size 16-28 an electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

D. The unit manufacturer shall install all power and control wiring.

E. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.09 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. Each module shall have two stages of heating control.

C. The heat exchanger tubes shall be constructed of stainless steel.

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

F. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.10 CONDENSING SECTION

A. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0~120°F. Mechanical cooling shall be provided to 25º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

C. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.

D. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have one of the following oil control features.

1. A separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line.
2. A separate oil pump and low oil safety protection [size 016-028].

E. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

F. Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

2.11 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. An optional fused disconnect and 65,000 amp SCCR capability shall be provided.

2.12 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Return air temperature.
2. Discharge air temperature.
3. Outdoor air temperature.
4. Space air temperature.
5. Outdoor enthalpy, high/low.
6. Compressor suction temperature and pressure
7. Compressor head pressure and temperature
8. Expansion valve position
9. Condenser fan speed
10. Inverter compressor speed
11. Dirty filter indication.
12. Airflow verification.
13. Cooling status.
14. Control temperature (Changeover).
15. VAV box output status.
16. Cooling status/capacity.
17. Unit status.
18. All time schedules.
19. Active alarms with time and date.
20. Previous alarms with time and date.
21. Optimal start
22. Supply fan and exhaust fan speed.
23. System operating hours.
    a. Fan
    b. Exhaust fan
    c. Cooling
    d. Individual compressor
    e. Heating
    f. Economizer
    g. Tenant override

G. The user interaction with the keypad shall provide the following:
   1. Controls mode
      a. Off manual
      b. Auto
      c. Heat/Cool
      d. Cool only
      e. Heat only
      f. Fan only
   2. Occupancy mode
      a. Auto
      b. Occupied
      c. Unoccupied
      d. Tenant override
   3. Unit operation changeover control
      a. Return air temperature
      b. Space temperature
      c. Network signal
   4. Cooling and heating change-over temperature with deadband
   5. Cooling discharge air temperature (DAT)
   6. Supply reset options
      a. Return air temperature
      b. Outdoor air temperature
      c. Space temperature
      d. Airflow (VAV)
      e. Network signal
      f. External (0-10 vdc)
      g. External (0-20 mA)
   7. Temperature alarm limits
      a. High supply air temperature
      b. Low supply air temperature
      c. High return air temperature
   8. Lockout control for compressors.
   9. Compressor interstage timers
   10. Night setback and setup space temperature.
   11. Building static pressure.
   12. Economizer changeover
      a. Enthalpy
      b. Drybulb temperature
   13. Currently time and date
   14. Tenant override time
   15. Occupied/unoccupied time schedule
   16. One event schedule
   17. Holiday dates and duration
   18. Adjustable set points
   19. Service mode
      a. Timers normal (all time delays normal)
      b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
   1. Zone sensor with tenant override switch
   2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
   1. Airflow
   2. Outside air temperature
   3. Space temperature
   4. Return air temperature
   5. External signal of 1-5 vdc
   6. External signal of 0-20 mA
   7. Network signal

2.13 CLOUD-ENABLED EQUIPMENT

A. Summary

1. The manufacturer shall provide a factory-installed equipment and facility management solution, which resides on the HVAC equipment. The solution shall provide monitoring, control, analysis, and decision-making capabilities using secure, cloud-communicating hardware., Capabilities shall include integrated equipment power measurement. Solution should be able to communicate to a user device (smart phone, tablet, etc.) via wireless (cellular, Wi-Fi) or local area network (LAN) connection. The subscription-based Software as a Service (SaaS) shall be available with one or more users views that provide site asset management, monitoring and controlling individual HVAC units. The solution shall provide cloud-based access to third party content, such as weather, utility, and CRM data. Equipment hardware shall consist of all components necessary to deliver unit controller and power data directly to the cloud.

B. MACHINE TO MACHINE (M2M) GATEWAY

1. A factory-installed, tested and commissioned Machine to Machine (M2M) Gateway shall deliver data directly to the cloud via wireless (cellular, Wi-Fi) or local area network (LAN) connection. Upon communication failure in one mode, solution shall be capable of automatically switching over to another means of connecting to the cloud.
2. The Machine (M2M) Gateway shall implement security, to include:
   a. Data delivery via secure HTTPS using SSL
   b. Virus and Malware protection
   c. Boot-level security
3. Hardware shall meet or exceed the following specifications:
   a. Intel Atom 1Ghz E640T processor + EG20T
   b. 1 GB Memory
   c. 8G SATA Fixed Storage
   d. 802.11 a/b/g/n Wi-Fi – Client
   e. 802.11 a/b/g/n Wi-Fi – Host
   f. Integrated Cellular SIM Holder
   g. Interfaces: RS-232; RS-485; USB 2.0; Wi-Fi Antenna Port; Cellular Antenna Port; Ethernet (Gigabit).
   h. Operating Environment: Operates in a temperature range of -40 to 158 degrees F. (-40 to 70 degrees C.). Relative humidity range of < 90%.
   i. RoHS Compliant
   j. Vibration/Shock: MIL-STD-810F
   k. EMC: CE, FCC, IC
   l. Safety: CE, UL, cUL, CB
   m. Power Regulation: SAE J1455, ISO 7637-2, SAE J1113
   n. PTCRB Certification

C. ENERGY MANAGEMENT MODULE

1. A factory-installed, tested and commissioned Energy Management Module (EMM), or equivalent, shall monitor unit voltage, current, and power and transmit this data to the Machine to Machine (M2M) Gateway for delivery to the Cloud.
2. Hardware shall meet or exceed the following specifications:
   a. Allow monitoring of single-phase, split-phase and 3-phase Y & Delta connections Module up to 600VAC (45-65 Hz) and up to 1000 A
   b. Allow an Operating Range of -40 to 185°F (-40 to 85°C) and Relative humidity > 90%, non-condensing
   c. UL 873, UL 916 recognized and the equivalent Canadian standard as a Test and Measurement Equipment in Industrial environments
   d. Comply with IEC 61032 finger safe for the terminal strip used (required for safety on safety)

D. INSTALLATION

1. Antennas shall be shipped loose from the factory, and shall be mounted and electrically-connected in the field by the contractor providing unit start-up and commissioning, per factory-supplied installation literature.
2. For sites using Local Area Network (LAN) connection to provide Cloud access, appropriate trades should coordinate to supply all necessary roof penetrations, conduit, network cable, network infrastructure, and termination to the network.

E. START-UP AND COMMISSIONING

1. Initial programming of Site information, Unit List, and User List and accompanying Passwords, shall be performed at the factory.
2. Technical and Customer users will complete the IE invitation process to gain access the UI for the connected equipment

2.14 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2"×4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

Daikin Applied Training and Development

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Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

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Catalog 250-6

Maverick™ II
Commercial Packaged Rooftop Systems

Heating & Cooling
Models MPS015F – 075F
15 to 75 Tons
R-410A Refrigerant



Engineered for flexibility and performance™

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The HVAC Solution for Low Rise Buildings

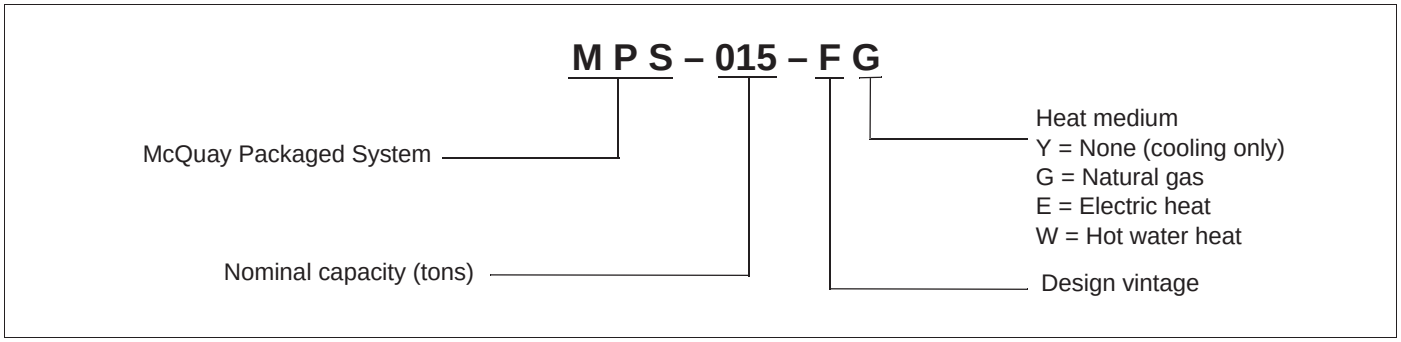
- Non-ozone depleting R-410A refrigerant.
- Variable air volume (VAV) or constant volume (CV) operation.
- EER meets ASHRAE 90.1 2007 (except the 75 ton unit).
- Durable, double wall construction with access doors on both sides.
- Gas heat option with staged or modulating control.
- Economizer with 80% to 100% exhaust.
- Building pressure control with a VFD.
- Factory integrated and commissioned MicroTech® III DDC control system.
- McQuay's Open Choices™ feature provides building automation system integration using BACnet® MS/TP, BACnet IP, or LonTalk® communication protocol options.
- Hinged access doors on both sides of the unit.
- Stainless steel sloped drain pan.
- 2" prefilters with option for 4" secondary filter on sizes 15–50, and 12" secondary filters on sizes 62–75.
- Airfoil fans provide non-overloading operation, better fan efficiency, and less noise.
- Energy recovery wheel with unitary construction and single-point power connection.

Agency Listed

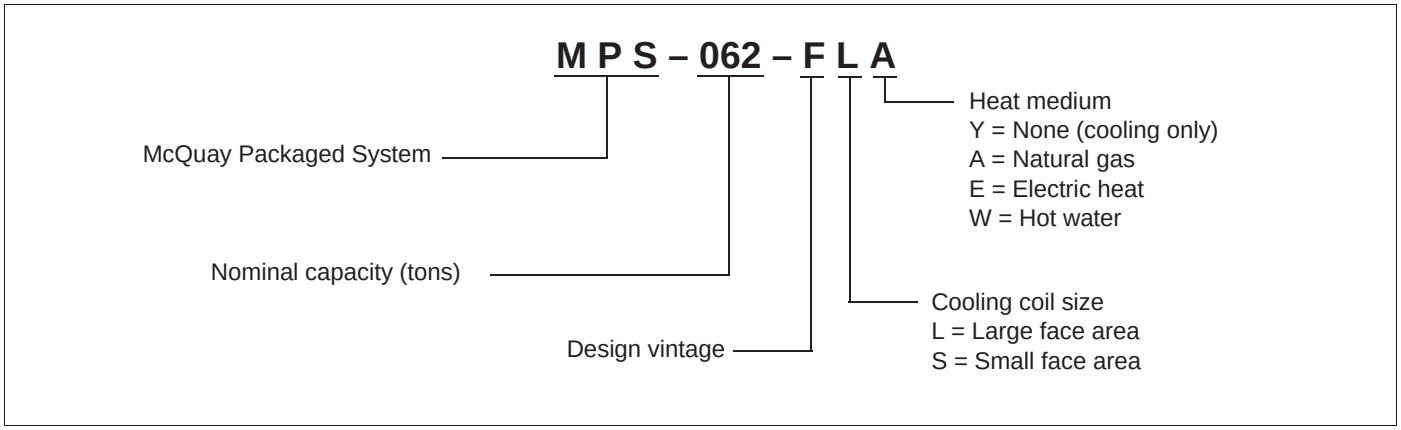
MEA

265-07-E

Nomenclature (MPS 015–050)



Nomenclature (MPS 062–075)

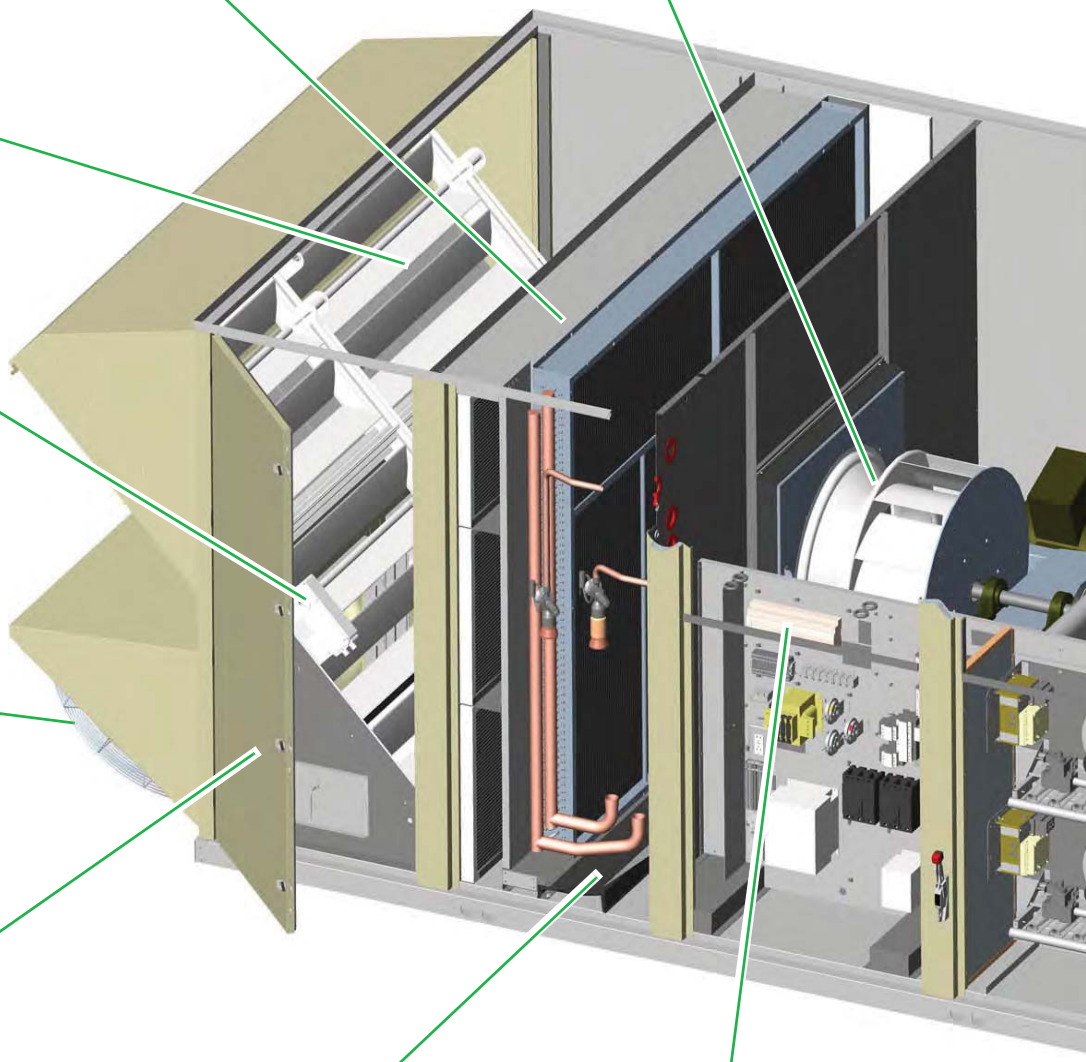


MPS 015–050 Features and Options

Airfoil plenum fan
- Energy efficient and quiet
- 1" seismic spring isolators for superior vibration control
- Class II construction
- Premium efficiency motor is standard

2"/4" combination filter rack
- Provides more flexibility to meet building filtration requirements
- 2" MERV 7 filters shipped with unit, owner preference thereafter

Low leak outside air dampers
- 4 cfm/ft^2 to meet ASHRAE Standard 90.1-2007
- Double-wall blades
- Blade edge and jamb seals



Economizer
- DCV control for efficient VAV operation
- CO_2 control for building IAQ

Exhaust fans with building pressure control
- Provide better building envelope airflow control which increases building operation efficiency

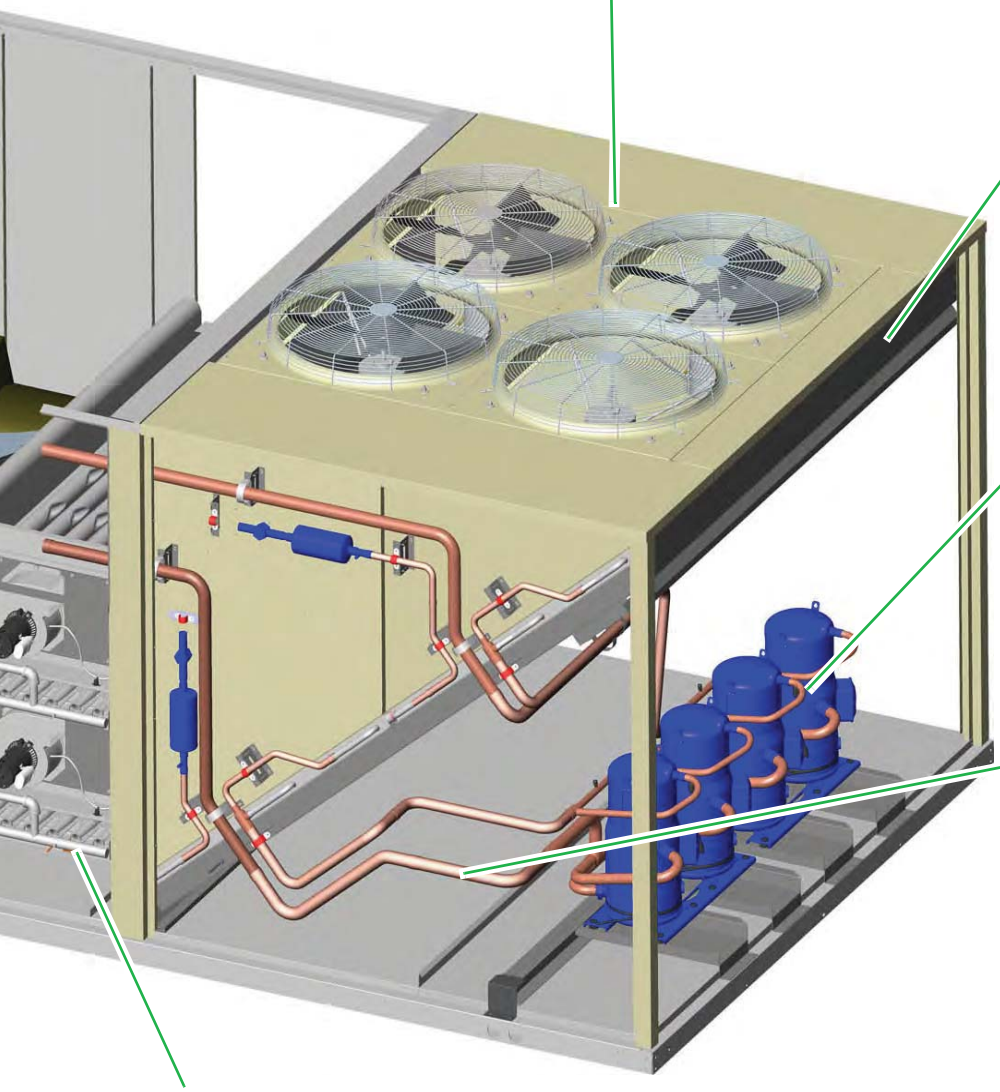
Hinged access doors
- On both sides of unit of every section for easy access to all components
- Easy open quarter-turn latches
- Double-wall construction protects insulation during maintenance

Stainless steel, double-sloped drain pan
- Prevents corrosion
- Avoids standing water for high IAQ

MicroTech® III unit controller
- Open Choices™ feature provides interoperability with BACnet or LonMark communications for easy integration into your building automation system of choice
- Outdoor air and humidity control logic maintains minimum fresh air intake and optimum humidity levels

Durable construction

- Pre-painted exterior cabinet panels pass 750-hour ASTM B 117 Salt Spray Test for durability
- Weather-resistant construction with capped seams and sloped top panels
- Double-wall construction protects R-4 insulation and provides wipe-clean surface



Microchannel condenser coils

- Proven technology from the automotive industry
- Suited for R-410A high operating pressures
- All aluminum design
- No corrosion between fins, tubes, and header

Scroll compressors

- Provide maximum dependability, efficiency, and quiet operation
- 2-5 stages of capacity control for efficient DAT control

R-410A refrigerant

- No ozone depletion potential or phase-out date
- Greater than 10.0 EER, meets ASHRAE 90.1-2007 energy requirements for the year 2010
- Dual refrigerant circuits provide redundancy for high unit reliability

Gas heat

- Tubular heat exchanger for maximum heat transfer
- Four-stage capacity control
- Optional 4-to-1 modulation control on low heat
- Optional 8-to-1 modulation control on high heat

Optional electric heat

- DDC with 4-stage control
- Operational safeties
- High-limit temperature switch
- Single point power

Optional hot water heat

- Low and high capacity options
- DDC control ready with 0–10 volt wiring harness
- Vestibule for field installed control valve package

MPS 015–050 Units with Energy Recovery Wheel Features and Options

2"/4" combination filter rack

- Provides more flexibility to meet building filtration requirements
- 2" MERV 6 filters shipped with unit, owner preference at building occupancy

Durable construction

- Pre-painted exterior cabinet panels pass 750-hour ASTM B 117 Salt Spray Test for durability
- Double-wall construction protects insulation and provides wipe-clean surface



Exhaust fans with building pressure control

- Provide better building operations, higher customer satisfaction

Optional energy recovery wheel

- Meets ASHRAE Standard 90.1-2007
- Factory installed
- Single point power

Hinged access doors

- On both sides of unit for easy access to all components
- Easy open, quarter-turn latches
- Double-wall construction protects insulation during maintenance

MicroTech® III unit controller

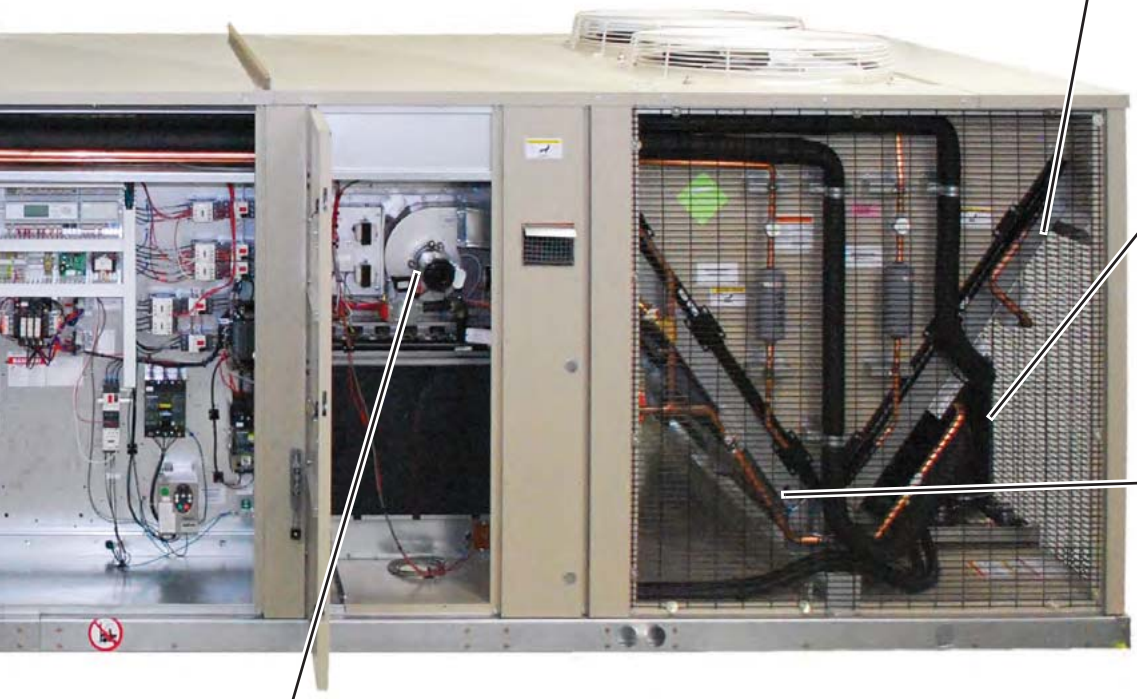
- Open Choices™ feature provides interoperability with BACnet or LonWorks communications for easy integration into your building automation system of choice
- Outdoor air and humidity control logic maintains minimum fresh air intake and optimum humidity levels

Airfoil plenum fan

- Energy efficient and quiet
- 1" seismic spring isolators for superior vibration control
- Premium efficiency motor is standard
- Vibration transmissibility of less than 5%

Microchannel condenser coils

- Proven technology from the automotive industry
- Suited for R-410A
- All aluminum design
- No corrosion between fins, tubes and header
- LEED® credit for enhanced refrigeration management



Scroll compressors

- Provide maximum dependability, efficiency and quiet operation

R-410A refrigerant

- No ozone depletion potential or phase-out date
- EER per ASHRAE 90.1 2007
- Dual refrigerant circuits provide redundancy for high unit reliability

Gas heat

- Tubular heat exchanger
- Aluminized steel or optional stainless steel tubes
- Staged or modulating control

Optional electric heat

- 4-stage control
- Operational safeties
- High-limit temperature switch
- Single point power connection

Optional hot water heat

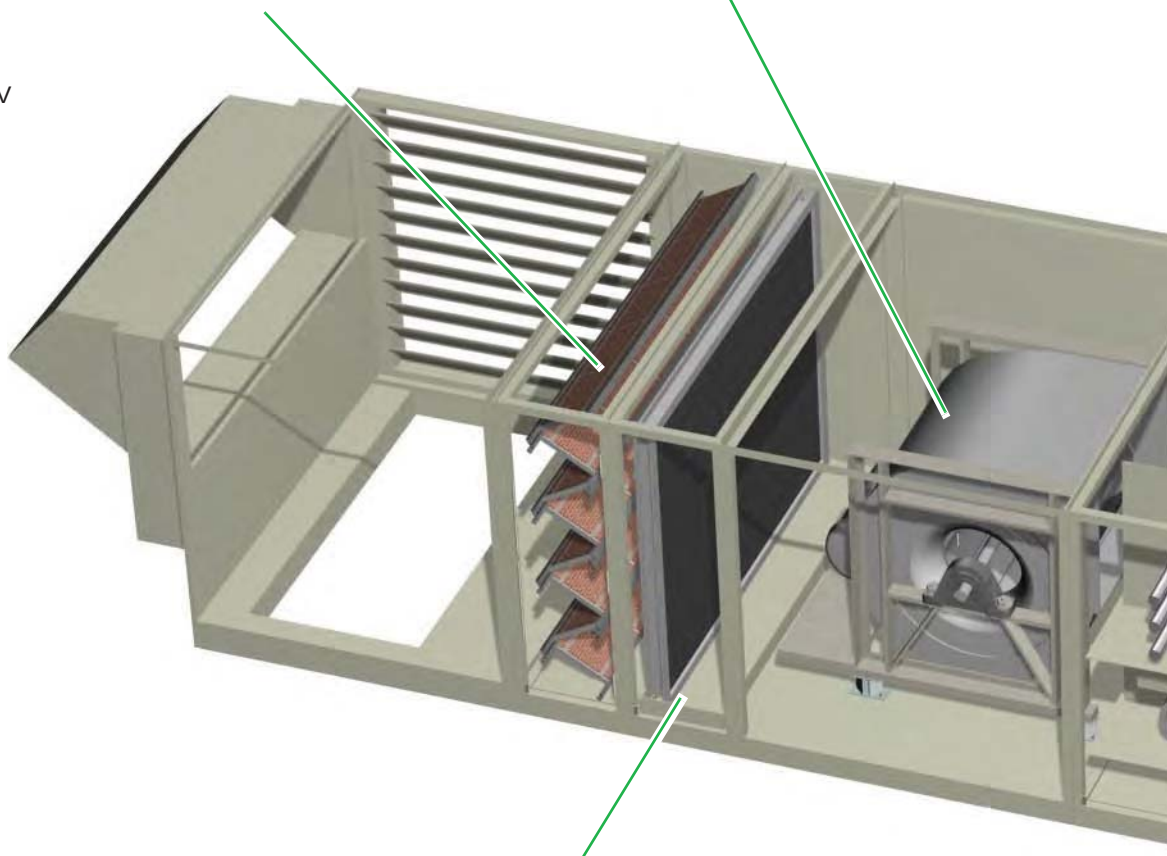
- Low and high capacity options
- DDC control ready with 0–10 volt wiring harness for water control valve
- Vestibule for field installed control valve package

MPS 062–075 Features and Options

Airfoil plenum fan (DWDI shown)
- Energy efficient and quiet
- 2" seismic spring isolators for superior vibration control
- Class II construction
- Premium efficiency motor is standard

Cartridge filters with prefilters
- 2", 30% MERV 7 angular (shown)
- 6", 60% MERV 11
- 12", 90% MERV 14

Economizer
- DCV control for efficient VAV operation



Low leak outside air dampers
- Double-wall blades
- Blade edge and jamb seals

Exhaust fans with building pressure control
- Provide better building envelope airflow control which increases building operation efficiency

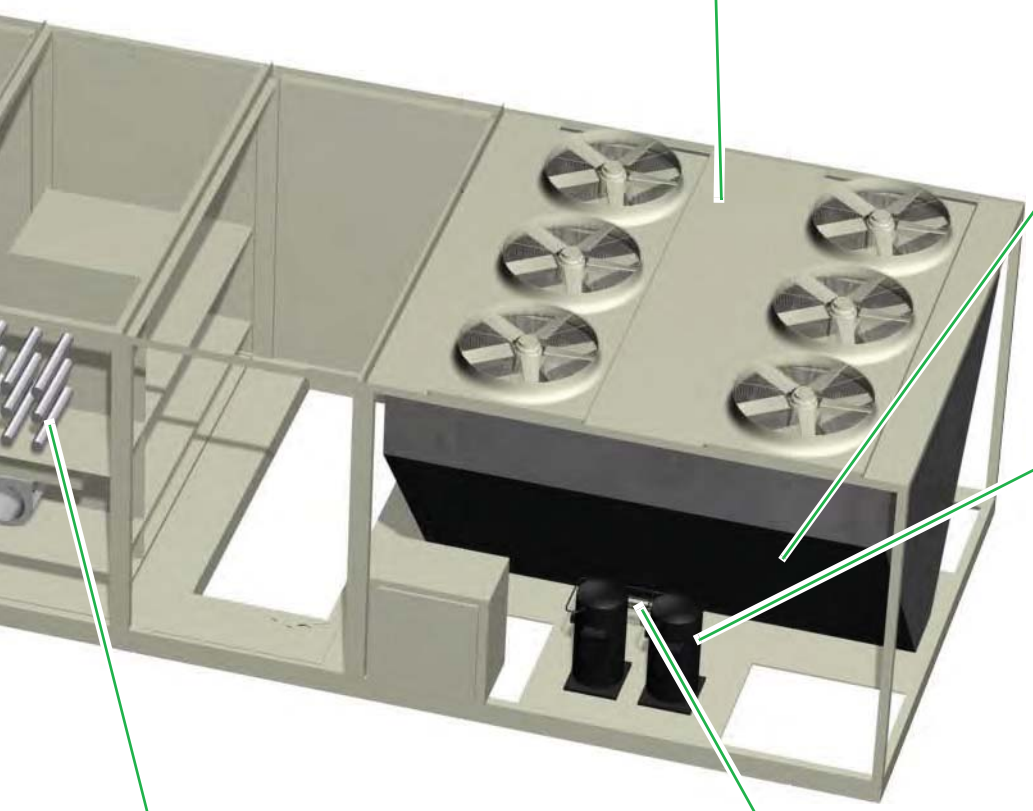
Hinged access doors
- On both sides of unit of every section for easy access to all components
- Easy open, single point latch
- Double-wall construction protects insulation during maintenance

Stainless steel, double-sloped drain pan
- Prevents corrosion
- Avoids standing water for high IAQ

MicroTech III™ unit controller
- Open Choices™ feature provides interoperability with BACnet or LonMark communications for easy integration into your building automation system of choice
- Outdoor air and humidity control logic maintains minimum fresh air intake and optimum humidity levels

Durable construction

- Pre-painted exterior cabinet panels pass 750-hour ASTM B 117 Salt Spray Test for durability
- Weather-resistant construction with capped seams and sloped top panels
- Double-wall construction protects R-6.5 insulation and provides wipe-clean surface



Microchannel condenser coils

- Proven technology from the automotive industry
- Suited for R-410A high operating pressures
- All aluminum design
- No corrosion between fins, tubes, and header

Scroll compressors

- Provide maximum dependability, efficiency, and quiet operation
- 4-6 stages of capacity control for efficient DAT control
- Discharge unit liquid line isolation valves standard

R-410A refrigerant

- No ozone depletion potential or phase-out date
- Meets ASHRAE 90.1-2007 energy requirements for the year 2010
- Dual refrigerant circuits provide redundancy for high unit reliability

Gas heat

- Drum and tube heat exchanger for maximum heat transfer
- 3-to-1 modulation control on low heat
- Stainless steel heat exchanger

Optional electric heat

- DDC with 4-stage control
- Operational safeties
- High-limit temperature switch
- Single point power

Optional hot water heat

- Low and high capacity options

Why Choose McQuay Rooftop Systems?

Maverick II rooftop systems are the HVAC solution for low rise building projects. Available with cooling capacities from 15 to 75 tons and energy efficiencies of 10.0 EER and higher.

Maverick II systems are built to perform, with features and options that provide for lower installed costs, high energy efficiency, good indoor air quality, quiet operation, low cost maintenance and service, and longevity. Completed systems are factory tested and shipped with a cETLus Safety Listing.

High Efficiencies and Competitively Priced

There's no longer any reason to wait until 2010 to specify non-ozone-depleting R-410A refrigerant for your building projects. Because McQuay now offers a complete line of R-410A rooftop systems that exceed both current efficiency minimums and the new 2010 efficiency minimums.All-Aluminum Condensers Resist Corrosion

McQuay R-410A rooftop systems use all-aluminum, microchannel condenser coils, which help eliminate galvanic corrosion, making them more resistant to corrosion in any environment, including seacoast applications.

Figure 1: Microchannel Condenser Coils



Easy, Low Cost Installation, Maintenance and Service

Maverick II units arrive at the job site as a complete package, including fully tested controls. This eliminates the need for expensive field assembly, refrigerant piping, and control installation. Hinged access doors on both sides of the unit put all components within easy reach for maintenance and service personnel. This promotes regular maintenance for peak system performance.

MicroTech III controls are easily accessed for equipment diagnostics and adjustments via a keypad/display on the unit. Our Open Choices feature provides interoperability with building automation systems (BAS), including those using the BACnet and LonTalk communication protocols. The result is easy access to all unit operating data from a central control station.

Figure 2: MPS 015–050 Example



Unit Construction

- Nominal unit cooling capacities from 15 to 75 tons.
- Pre-painted exterior surfaces that withstand a minimum 750 hour salt spray test per ASTM B117.
- Double-wall hinged access doors on both sides of the unit.
- Heavy-gauge, galvanized steel unit base with a formed recess to seat on roof curb gasket and provide positive weather-tight seal.
- Rigging brackets integral to the unit base.
- Double-wall construction to protect the insulation, enhance performance, and satisfy IAQ requirements.

Controls

- Integrated advanced MicroTech III DDC controls with unit-mounted interface featuring a 4-line, 20-character English display for fast equipment diagnostics and adjustments, providing the best possible comfort to the space while saving energy and money.
- Controls factory installed and commissioned prior to shipment for fast start-up.
- Open Choices feature allows interoperability with a BAS, including those using BACnet and LonTalk communication protocols for integrating into Building Automation Services.

Figure 3: MicroTech III Unit Controller



Variable Air Volume Control

- Factory mounted energy saving variable frequency drive (VFD) fan speed control.
- All VFDs are factory installed and tested.
- To manage building static pressure, the exhaust fans have an option for being controlled by a VFD.
- MicroTech III controls provide advanced duct and building static pressure control and equipment diagnostics capability.

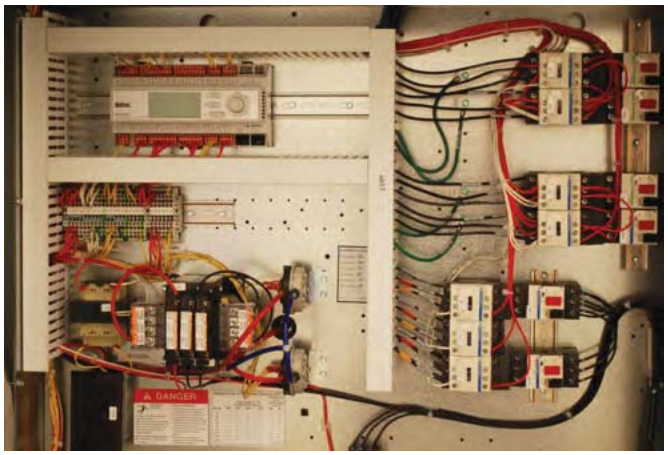
Figure 4: Variable Frequency Drives



Electrical

- Units are completely wired and tested at the factory to provide faster commissioning and start-up.
- Wiring complies with NEC requirements and all applicable UL standards.
- All units have a minimum short circuit current rating of 10,000 amps.
- For ease of use, wiring and electrical components are number coded and labeled according to the electrical diagram.
- Units have a 115 V GFI convenience receptacle. The independent power supply for the receptacle is field supplied.
- An optional unit powered 20 amp 115 V convenience receptacle, complete with factory mounted transformer, disconnect switch, and primary and secondary overload protection, eliminates the need to pull a separate 115 V power source.
- Supply air fan, compressor, and condenser fan motors branch circuits have individual short circuit protection.
- A single point power connection with power block or disconnect switch is standard.
- The optional unit-mounted disconnect includes a service handle on the exterior of the unit.
- Electrical power feeds inside the perimeter roof curb through factory provided knockouts located in the bottom of the main control panel.

Figure 5: Control Panel Section (MPS 015–050)



Supply Fan Section

- Airfoil blade fans provide superior energy performance and quiet operation.
- Class II construction.
- Concentric locking bearing.
- Minimum, standard 1" seismic spring isolation reduces noise transmission into the space.
- Each fan assembly is dynamically trimmed balanced at the factory.

Figure 6: Fan Section (MPS 015–050)



- A neoprene gasket isolates the fan housing and eliminates vibration transmission to the fan bulkhead.
- Solid steel fan shafts rotate in 200,000 hour regreasable pillow block ball bearings, providing years of reliable operation.
- All fan and motor assemblies are isolated from the main unit on 1" deflection spring mounts (2" deflection on 62–75 ton units).
- All fan drives have fixed pitch sheaves as standard.

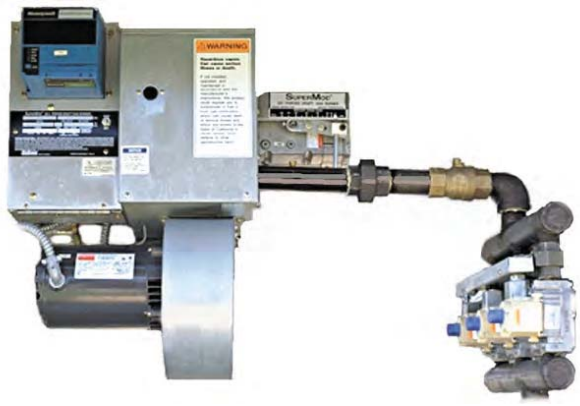
Gas Heat Option

- Natural gas heating is provided with modular heat exchangers.
- Optional stainless steel heat exchanger (standard on 62–75 ton units) and optional modulating gas heat with turndowns as high as 8:1, save energy and supply greater comfort to the space.
- All gas burners exceed ASHRAE Standard 90.1 efficiency requirement of 78% for low fire and 80% for high fire.
- Gas burners are UL listed with the complete furnace assembly cETLus listed.
- All burner assemblies are factory tested and adjusted prior to shipment.

Figure 7: Gas Heat Section (MPS 015–050)



Figure 8: Gas Heat (MPS 062–075)



- 15–50 ton unit heat exchangers are air induced draft tubular design with in-shot burner manifolds.
  - Low heat option has one module with two stages of heating capacity.
  - High heat option has two modules with four stages of heating capacity control.
- 62–75 ton unit heat exchangers are a forced draft drum and tube design.
- Fuel lines may be conveniently routed through the curb or the burner vestibule.
- Heating control is fully integrated into the unit's MicroTech III control system.
- Optional field installed LP kits are available.

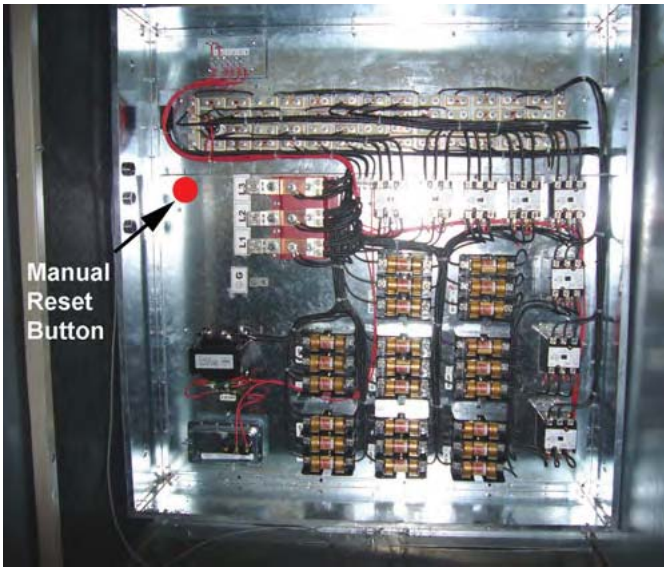
Energy Recovery Wheel

- Optional energy recovery wheel for increase efficiency for conditioning minimum outdoor air.
- Unitary design for installation/rigging cost savings.
- Single point power connection for decreased installation cost
- Slide-out wheel cassette & track for easy maintenance and cleaning.
- Bypass dampers for increased efficiency during economizer operation.
- Integrated unit control for control coordination between rooftop unit and wheel that controls the wheel speed.
- Leaving wheel temperature sensors for wheel operation monitoring.
- Integrated unit control with optimum leaving wheel temperature control to prevent over-heating the outdoor air.
- Defrost options including ON/OFF control, Start/Stop and VFD speed modulation.

Electric Heat Option

- Low, medium, and high kW furnace options for matching the requirements of any project.
- 4 stages of DDC control.
- Single point power connection eliminates the need to pull multiple power connections.
- Operational safeties.
- High-limit temperature switch.
- Individual coil fusing.

Figure 9: Electric Heat Section



Hot Water Heat Option

- 1 and 2-row, low and high output options.
- Fully cased coil.
- Factory installed coil vent and drain.
- Piping vestibule for field installed piping control package.
- DDC control ready with 0–10 volt wiring harness.
- Optional valve package on size 62–75.

Modulating Hot Gas Reheat Option

- All aluminum coil construction eliminates corrosion and provides better heat transfer.
- Controls leaving air temperature and leaving air dew point.
- Low volume microchannel coil eliminates the need for refrigerant receivers
- By over-cooling the conditioned air, excessive humidity is reduced to prevent mold growth and sick building syndrome
- Modulating control provides precise temperature reheat control to keep conditioned space better satisfied

Outside Air Options

Maverick II units are available with a 0% to 30% outdoor air damper or a 0% to 100% economizer.

0% to 30% Outside Air Option

- Includes return air plenum and 0% to 30% outside air intake hood with motorized dampers to minimize leakage during off cycles.
- Damper is field adjusted to a fixed open position that is easily set using the MicroTech III keypad, allowing for a balance between IAQ and energy savings.

0% to 100% Economizer Option

- A fully functional modulating economizer takes advantage of free cooling days.
- Includes return air plenum with back or bottom opening, exhaust air relief dampers and low leak economizer dampers to minimize leakage during off cycles.
- Economizer control is fully integrated into the unit's MicroTech III control system and features spring-return actuator, adjustable minimum outside air set point and adjustable changeover.
- Dry bulb economizer changeover control is standard. Optional comparative enthalpy control provides the most economical amount of outside air for “free” cooling.
- Barometric relief dampers are standard for exhaust control.

0% to 100% Outdoor Air (OA) Option

- Unit can be equipped with a 100% OA damper.
- Damper is fully modulating for field adjustment to required air flow at the installation site.
- Damper is actuated to minimize leakage during off cycles.

Prop Exhaust Fans

- MicroTech III controls provide staged capacity control as standard.
- MicroTech III controls can provide an optional VFD control for building static pressure control. The building pressure transducer is included in the control panel.
- Building static pressure control is important in minimizing exfiltration, energy consumption, and preventing mold growth.

Condensing Section

- Open design permits unrestricted condenser airflow, access to compressors, and refrigeration components and piping.
- Condenser coil hail protection is integral with the design.
- High efficiency scroll compressors.

Figure 10: Condensing Section (MPS 015–050)



- Each refrigerant circuit is furnished with an accessible sightglass, filter drier, high pressure switch, low pressure switch, and expansion valve.
- All units feature dual refrigeration circuits for redundancy and efficient capacity control.
- Vertical air discharge minimizes condenser fan noise.
- Three-phase condenser fan motors eliminate reverse rotation failures.
- A vandal protection screen is standard on 15–50 ton units and optional on 62–75 ton units.

Cooling Coil/Drain Pan Section

- Evaporator coils with enhanced copper tubing and aluminum fins, provide high efficiencies at full and part load operating conditions.
- All evaporator coils feature interlaced circuiting to keep the full face of the coil active and eliminate air temperature stratification, allowing the cooling coil maximum humidity control.
- Construction will include stainless steel drain pans to eliminate corrosion.
- Drain pan is sloped 1/8"/ft per the requirements of ASHRAE, eliminating standing water and preventing bacteria growth.

Filter Section

- Combination 2" – 4" filter tracks are provided for 15–50 ton units. Single or combination tracks may be used for the building's filtration needs.
- 62–75 ton units are available with 2", 30% MERV 6 angular filters, 6", 60% MERV 11 cartridge filters, or 12", 90% MERV 14 filters. MERV 11 and MERV 14 filters also include MERV 6 prefilters.
- Multiple access doors allow easy filter changes from either side of the unit.

Roof Curbs

- Constructed in accordance with NRCA guidelines with 12-gauge galvanized steel.
- Fits inside the unit base. 15–50 ton units use a full perimeter curb. 62–75 ton units use an air handler curb with an island rail for the condensing unit.
- Gasket seals between the curb and the unit.

Superior Performance and Easy Integration

Each Maverick II rooftop unit is equipped with a complete MicroTech III unit control system that is pre-engineered and factory tested prior to shipment. Its features include:

- Stable, efficient temperature and static pressure control.
- Comprehensive diagnostics.
- Alarm monitoring.
- Alarm-specific component shutdown if critical equipment conditions occur.

The MicroTech III control system comes standard with a user interface, providing system operators with superior access to temperatures, pressures, operating states, alarm messages, control parameters, and schedules. All messages display in English text. Password protection is included to protect against unauthorized or accidental set point or parameter changes.

MicroTech III control system components include:

- DDC controller with keypad/display user interface.
- Ductwork or building pressure transducers.
- Unit-mounted temperature sensors.
- Field installed zone temperature sensor packages.
- Enthalpy sensors/controllers.
- Field installed CO_2 sensors.

Open Choices™ Feature

MicroTech III unit control systems are factory configured for either stand-alone operation or for incorporation into an independent building automation systems (BAS) through McQuay's Open Choices feature. This feature provides building automation system integration using BACnet MS/TP, BACnet IP, or LonTalk communication protocol options.

BACnet communications conform to the BACnet Standard, ANSI/ASHRAE Standard 135-2004, and are supported by a protocol implementation conformance statement (PICS).

LonTalk communications are in accordance with either the Discharge Air Controller (DAC) or Space Comfort Controller (SCC) profiles and are LONMARK 3.4 certified.

The building automation system can interact with one or more rooftop unit controllers in any of the following ways:

- Sets the unit's operating and occupancy modes.
- Monitors all controller inputs, outputs, set points, parameters, and alarms.
- Sets controller set points and parameters.
- Clears alarms.
- Resets the cooling discharge air temperature set points (VAV units).
- Resets the duct static pressure set point (VAV units).
- Sets the heat/cool changeover temperature.
- Sets the representative zone temperature (CAV-ZTC units).

DDC Unit Controller

The DDC controller contains a microprocessor that is preprogrammed with the software necessary to control the unit. This can keep schedules, set points and parameters from being lost, even during a 48-hour power outage. The microprocessor board processes system input data and then determines and controls output responses.

Communication Modules

Field installed communication modules provide the means to configure MicroTech III unit controls for interoperability with an independent BAS using McQuay's innovative Open Choices feature. Communication modules are available to support BACnet MS/TP, BACnet/IP, and LONMARK communication protocols.

Keypad/Display

The keypad/display provides a user interface with the main controller and has easy-to-use keys and control knob used for navigation and entering changes. The display is a 4-line by 20-character format with clear English display messages. All operating conditions, system alarms, control parameters and schedules can be monitored from the keypad/display. If the correct password has been entered, any adjustable parameter or schedule can be modified from the keypad.

Figure 11: Keypad/Display Interface



Unit Sensors

Temperature and Enthalpy Sensors

The return, discharge, and outside air temperature sensors are factory installed. The zone temperature sensor package can be ordered as a field installed option.

Zone Temperature Sensors

Two optional zone temperature sensors are available:

1. Zone sensor with tenant override.
2. Zone sensor with tenant override and remote set point adjustment.

Timed tenant override is a standard MicroTech III control feature.

Zone sensors are required for the controller's space reset of supply air set point and night setback features. All zone sensors are field installed with field wiring terminated at the unit controller.

The optional comparative enthalpy control economizer package is provided with the enthalpy sensor for the return air and outside air factory installed.

Static Pressure Transducers

When the McQuay Packaged System is ordered with the VAV option, the duct static pressure transducer is factory installed as standard. The units can also have an exhaust fan option. The exhaust fans on VAV units are controlled by the building static pressure control package. The exhaust fans on CAV units are controlled by either the building static pressure control package as mentioned above, or they are controlled by the DDC program based on the outside air damper position. The static pressure transducers are factory installed when building static pressure control is ordered. The installation and routing of the field-supplied sampling tubes is done at the time of the unit installation.

Stand-Alone Controller Features

MicroTech III rooftop unit controls include all of the essential features required to make them capable of independent and stand-alone operation.

Auto/Manual Operation Selection

Automatic or manual operation can be controlled at the keypad. The keypad provides a variety of occupancy and auto/manual control mode selections available to the operator:

Occupancy Modes
Auto
Occupied
Unoccupied
Bypass (tenant override)

Control Modes
Off Manual
Auto or Heat/Cool
Cool Only
Heat Only
Fan Only

Cooling and Heating Lockout Control

All unit controls include separate keypad-programmable set points for locking out mechanical cooling and heating. Mechanical cooling is locked out when the outdoor temperature is below the cooling lockout set point. Heating is locked out when the outdoor temperature is above the heating lockout set point. This feature can save energy cost by eliminating unnecessary heating and cooling during periods when the outdoor air temperature is mild.

Night/Unoccupied Setback

When one of the zone temperature sensors is connected to the unit controller, night setback heating control and night setback cooling control are available. Separate, keypad-programmable, night heating and night cooling set points are used to start the unit when necessary. After the unit starts, night setback control is similar to normal occupied control except that the minimum outside air damper position is set to zero. If the outside air is suitable for free cooling, it is used during night setback operation.

Internal Time Clock

An internal time clock is included in the MicroTech III unit controller. Current date and time can be quickly and easily set at the user interface keypad.

Internal Schedule

Seven daily schedules and holiday schedules can be entered at the keypad of all unit controllers. For each of these eight schedules, one start and one stop time can be entered. Up to 16 holiday periods of any duration can be designated. The unit will automatically run according to the holiday schedule on the holiday dates.

In lieu of its internal schedule, the unit can be operated according to a network schedule from a BAS.

External Time Clock or Tenant Override Input

An input is supplied that can be used to accept a field wired start/stop signal from a remote source. An external time clock, a tenant override switch, or both may be connected. Whenever the external circuit is closed, the controller overrides the internal schedule (if activated) and places the unit into the occupied mode.

If the internal schedule or a BAS network schedule is used, field wiring is not required.

Timed Tenant Override

Off-hour operation flexibility is a must in today's office environments and the stand-alone MicroTech III controls handle it with ease. When unit operation is desired during unoccupied hours the tenant override button on either of the optional zone sensor packages is pressed to initiate the override operation. The unit then starts and runs in the occupied mode for a keypad-adjustable length of time (up to five hours). If the button is pressed again while the unit is operating, the timer resets to the full time allowance without interrupting unit operation. Tenant override operation can also be initiated by a BAS.

Remote Set Point Adjustment Options

All constant air volume-zone temperature control (CAV-ZTC) unit controllers include an input that can be used to remotely adjust the zone cooling and heating set points. To use this feature, wire the optional zone sensor package with set point adjustment to the controller. The remote set point adjustment feature can be enabled or disabled from the keypad at any time. When enabled, the remote set point adjustment is available even if the return temperature is selected to be the control temperature.

The building automation system (BAS) can also remotely adjust the unit's setpoints.

Standard Control Options

MicroTech controls offer two basic control configurations; (1) variable air volume with discharge temperature control (VAV-DTC) or (2) constant air volume with zone temperature control (CAV-ZTC).

All control configurations use sophisticated state change control logic to provide stable, reliable and efficient control. When combined with MicroTech's many available control capabilities–both factory installed and keypad programmable–these basic configurations can be customized to meet the requirements of the most demanding applications.

Configuration 1: Variable Air Volume with Discharge Temperature Control (VAV-DTC)

MicroTech VAV-DTC controls provide discharge air temperature control along with duct static pressure control. The operator can enter the desired cooling set point and VAV parameters at the keypad.

Configuration 2: Constant Air Volume with Zone Temperature Control (CAV-ZTC)

MicroTech CAV-ZTC controls provide the sophisticated and flexible zone temperature control that is only possible with DDC systems. Zone temperature sensors are available with or without a remote set point adjustment. With the remote adjustment model, the space set point can be set at the keypad or at the zone sensor package. (Even if a zone sensor is connected, remote set point adjustment can be enabled or disabled as desired at the keypad.)

Control Temperature

The Control Temperature for VAV-DTC or CAV-ZTC determines whether the unit supplies heating, cooling, or neither. It also determines the amount of heating or cooling required to satisfy the load. Its source can be selected at the keypad from among the following selections:

- Zone temperature sensor.
- Return temperature sensor.

Supply Air Reset

By automatically varying the discharge air temperature to suit a building's cooling or heating needs, supply air temperature reset can increase the energy efficiency of VAV systems. MicroTech controllers offer a variety of different reset strategies that can be selected at the keypad. Because they are keypad-programmable, reset strategies can be changed or eliminated as desired. Separate strategies can be selected for both cooling and heating. If reset is not desired, a fixed discharge cooling or heating set point can be entered.

The following reset methods are available:

- Space temperature.
- Return temperature.
- Outdoor air temperature.
- Supply airflow (VAV, cooling set point only).
- External 0–10 V (dc) or 0–20 mA signal.
- Network communication.

For all temperature reset methods, the minimum and maximum cooling and heating set points are keypad programmable along with the corresponding minimum and maximum space, return or outdoor air temperature parameters. For the supply airflow method, the discharge set point will be reset as the supply fan modulates between 30% (adjustable) and 100% (adjustable). For the external method, the discharge set point will be reset as the voltage or current signal varies over its entire range. For units in a BAS network, the discharge set points are reset via the communication signal.

Compressor Control

Compressor Staging

Compressor staging is controlled directly by the control temperature. When the control temperature is warmer than the cooling set point, cooling is staged up; when the control temperature is cooler than the cooling set point, cooling is staged down. However, a stage change can only occur when the control temperature is outside the dead band. Staging is constrained by an inter-stage delay timer (five minute default setting) and minimum and maximum discharge air temperature limits (all keypad programmable). These constraints protect the compressors from short cycling while eliminating temperature variations near the diffusers.

Project Ahead Algorithm

Because of the inherent thermal inertia in a building, zone temperature control applications can cause overshoot during warm-up or cool-down periods, MicroTech features a “Project Ahead” control algorithm. “Project Ahead” calculates the rate at which the control temperature is changing and reduces the unit's cooling or heating output as the zone temperature nears its set point, essentially eliminating overshoot.

Energy Recovery Control

The energy recovery wheel option has integrated control with the units DDC controller. Temperature sensors are mounted at the wheel to coordinate its operation with the rooftop unit. The outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature are connected to the rooftop unit controller. These temperatures are also available as BACnet variables for the BAS integration option. The operational performance of the wheel and unit is maximized with this integrated control. The benefit of the integrated control is that it will montior the leaving wheel temperature and prevent the wheel operation from overheating the outdoor air, which will force the building into the cooling mode of operation and consume more energy.

Frost control can be provided by a number of options. The standard offering for frost protection is to stop the wheel when a frost condition is encountered. The second option is to have the start-stop-jog control to prevent the wheel from reaching a frost condition. The third option for frost control is VFD proportional control. The speed of the wheel is varied to prevent the wheel from entering a frost condition. This option maximizes the amount of energy savings and also prevents the frost condition.

Supply Fan Control

Duct Static Pressure Control

On all VAV-DTC units, duct static pressure control is maintained by a control algorithm which provides precise control of the supply fan variable frequency drive. The keypad programmable set point can be set between 0.20" wc and 2.00" wc.

Economizer Control

Economizer Changeover Selection

On units equipped with an economizer, there are two methods of determining whether the outdoor air is suitable for free cooling.

- The standard offering uses an internal dry bulb changeover strategy: the unit controller compares the outdoor air dry-bulb temperature to a keypad-programmable set point.
- The optional second method is a comparative enthalpy control. It uses a solid state device that compares the outdoor air ambient enthalpy to the return air enthalpy. When the outdoor air enthalpy is lower than the return air enthalpy, the unit will change to economizer operation.

Minimum Ventilation Air Volume Control

Consistently maintaining the minimum outdoor air requirements of ASHRAE Standard 62 has been a long-standing control challenge for VAV systems. As supply air fan volumes were reduced, the volume of air introduced through a fixed-position, minimum outdoor air damper was also reduced, compromising indoor air quality. To meet this challenge, MicroTech controls feature user-selected control methods for maintaining outdoor air volume.

MicroTech controls have a keypad-selected control function that automatically adjusts outdoor air damper position in response to changes in supply air fan volume. Regardless of supply air volume, this strategy maintains a nearly constant outdoor air volume at all times.

The outdoor air damper position can also be controlled by the following:

- The MicroTech controller can accept an external 0–10 V (dc) or a 0–20 mA signal from a control device or from a CO_2 sensor.
- The MicroTech controller can accept a BAS network signal for the minimum position.
- A fixed minimum damper position can be keypad programmed. This selection may be acceptable when ventilation requirements are met through other sources.

During cold ambient conditions where the mixed air temperature of the minimum outdoor air and the return air can become too low, MicroTech controls maintain the minimum discharge temperature set point by controlling the unit's heating system.

Exhaust Fan Control

Building Static Pressure Control

Any constant or variable air volume Maverick unit with an optional variable volume exhaust fan can be provided with direct building static pressure control capability. The building static pressure is measured and processed by the unit DDC controller. The controller provides precise control of the exhaust fan's variable speed drive to maintain the space pressure set point. The range of the keypad-programmable set point is between –0.25 and +0.25" wc.

Field Output Signals

All MicroTech controls include two solid-state relay outputs that are available for field connection to any suitable device: a remote alarm output and a fan operation output. These outputs are used to signal field equipment of unit status.

Remote Alarm Output

The remote alarm output can be used to operate a 24 V relay to provide a remote alarm signal to a light, audible alarm, or other device when an alarm condition exists at the unit.

Fan Operation Output

The fan operation output is used to operate a 24 V relay to control field equipment that depends on fan operation, such as field-installed isolation dampers or VAV boxes. To allow actuators enough time to stroke, the fan operation output is energized three minutes before the fan starts. It then remains energized until thirty seconds after the unit airflow switch senses no airflow. The fan operation output is on whenever the unit airflow switch senses airflow.

Alarm Management and Control

MicroTech unit controllers are capable of sophisticated alarm management and controlled response functions. Each alarm is prioritized, indicated, and responded to with the appropriate action. The current alarm (up to four alarms, arranged by alarm priority), each with a time and date stamp, can be displayed at the user interface.

Alarm Priority

The various alarms that can occur are prioritized according to the severity of the problem. Three alarm categories are used: (1) Faults, (2) Problems, and (3) Warnings.

1. Faults are the highest priority alarms. If a fault condition occurs, the complete unit is shut down until the alarm condition is gone and the fault is manually cleared at the keypad. A fault example is a “Fan Fail” alarm.
2. Problems are the next lower priority to faults. If a problem occurs, the complete unit does not shut down, but its operation is modified to compensate for the alarm condition. A problem automatically clears when the alarm condition that caused it is gone. “Lo Pres-Ckt1” is an example of a problem where only the affected compressor is shut down.
3. Warnings are the lowest priority alarms. No control action is taken when a warning occurs; it is simply indicated to alert the operator that the alarm condition needs attention. To remind the operator to read warnings, they must be manually cleared. “Dirty Filter” indication is an example of a warning.

Table 1: MicroTech Alarm Summary

Alarm name	Fault	Problem	Warning
Emergency Off	X		
Control T Fail	X		
Disch Sensor	X		
Duct Hi Limit	X		
Hi Return Tmp	X		
Hi Disch Tmp	X		
Lo Disch Tmp	X		
Fan Fail	X		
OAT Sensor		X	
Space Sensor		X	
Return Sensor		X	
Hi Pres-Ckt1		X	
Hi Pres-Ckt2		X	
Lo Pres-Ckt1		X	
Lo Pres-Ckt2		X	
Dirty Filter			X

General Rooftop Applications

Units are intended for use in normal heating, ventilating, and air conditioning applications. Consult your local McQuay sales representative for applications involving operation at high ambient temperatures, high altitudes, non-cataloged voltages, and for job specific unit selections that fall outside of the range of the catalog tables.

For proper operation, units should be rigged in accordance with instructions stated in IM 842. Fire dampers, if required, must be installed in the ductwork according to local or state codes. No space is allowed for these dampers in the unit. Follow factory check, test and start procedures explicitly to achieve satisfactory start-up and operation (see IM 842).

Most rooftop applications take advantage of the significant energy savings provided with economizer operation. When an economizer system is used, mechanical refrigeration is typically not required below an ambient temperature of 50°F. Standard MPS refrigeration systems are designed to operate in ambient temperatures down to 20°F for 15–50 ton units or 45°F for 62–75 ton units.

Unit Location

The structural engineer must verify that the roof has adequate strength and ability to minimize deflection. Take extreme caution when using a wooden roof structure.

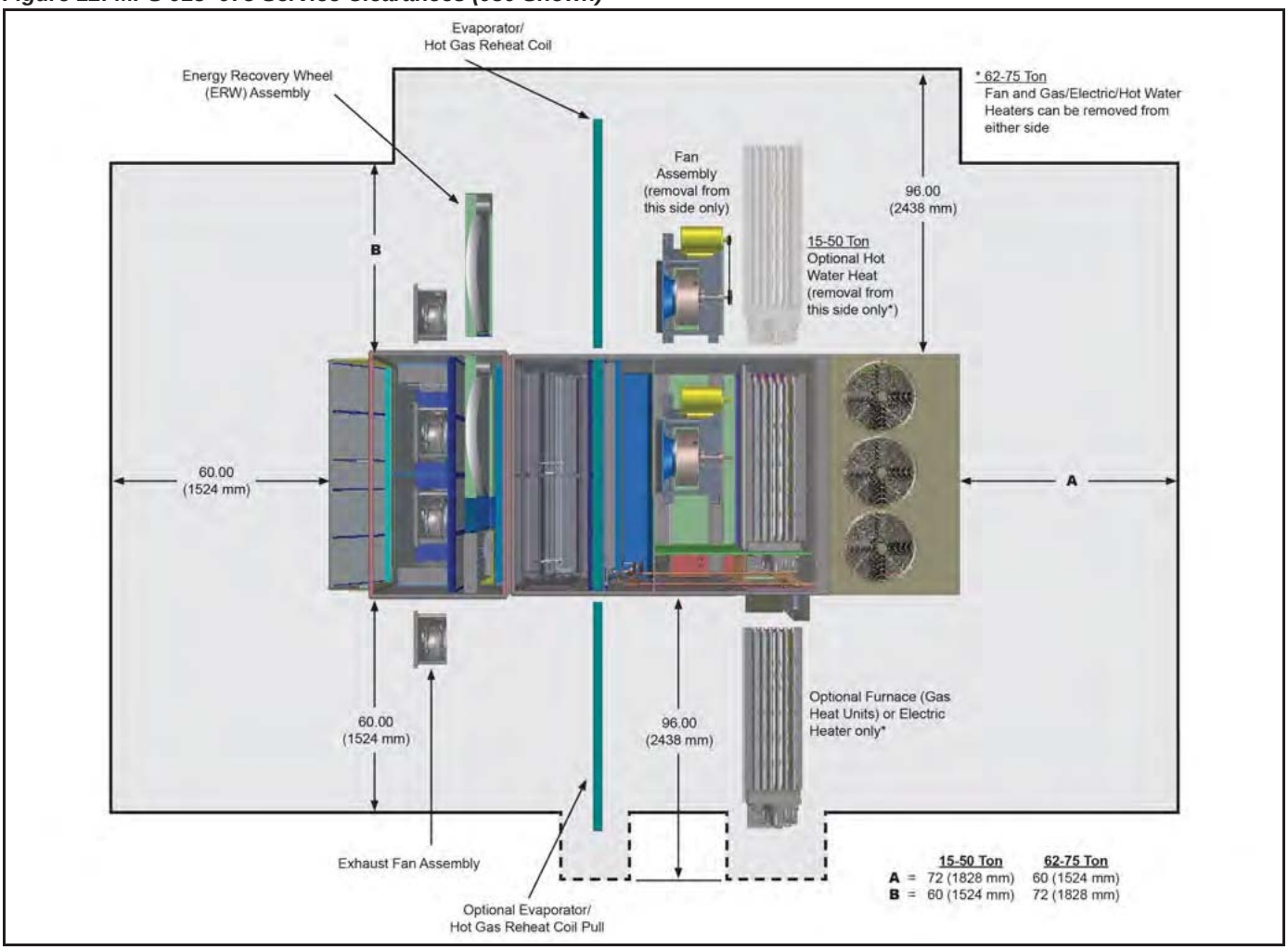
Unit condenser coils should be located to avoid contact with any heated exhaust air.

Allow sufficient space around the unit for maintenance/service clearance. Refer to Figure 12 for recommended clearances. Consult your McQuay sales representative if available clearances do not meet minimum recommendations. Where code considerations, such as the NEC, require extended clearances, they take precedence.

Service Clearance

Allow recommended service clearances as shown in Figure 12. Provide a roof walkway along the sides of the unit for service and access to controls and components. Contact your McQuay sales representative for service requirements less than those recommended.

Figure 12: MPS 015–075 Service Clearances (030 Shown)



Curb Installation

The roof curb is field assembled and must be installed level (within 1/16" per foot side to side). A sub-base has to be constructed by the contractor in applications involving pitched roofs. Gaskets are furnished and must be installed between the unit and curb. For proper installation, follow NRCA guidelines. Typical curb installation is illustrated in Figure 51, page 64 and Figure 60, page 73. In applications requiring post and rail installation, an I-beam securely mounted on multiple posts should support the unit on each side. In addition the insulation on the underside of the unit should also be protected from the elements.

Applications in geographic areas subjected to seismic or hurricane conditions must meet code requirements for fastening the unit to the curb and the curb to the building structure.

Acoustical Considerations

Good acoustical design is critical for any installation and should start at the earliest stages in the design process. Common sound paths for rooftop equipment must be addressed are:

- Radiated sound through the bottom of the unit (air handling section and condensing section) and into the space.
- Radiated sound to the property line.
- Structure-borne vibration from the unit to the building.
- Airborne sound through the supply air duct.
- Airborne sound through the return air duct.

Locating rooftop equipment away from sound sensitive areas is critical and the most cost effective means of avoiding sound problems. If possible, rooftop equipment should always be located over less sensitive areas such as corridors, toilet facilities or auxiliary spaces and away from office areas, conference rooms and classrooms.

Some basic guidelines for good acoustical performance are:

- Provide proper structural support under all areas of the unit.
- Always locate the unit's center of gravity close to a main support to minimize roof deflection.
- Use a concrete deck or pad when a unit has to be located over an occupied space where good acoustics are essential.
- Only the supply and return air ducts should penetrate the acoustical material and decking within the curb perimeter, and the openings must be sealed once the duct is installed.
- Don't overlook the return air path. Never leave a clear “line of sight” into a return or exhaust fan; always include some duct work (acoustically lined tee) at the return inlet.
- Place an acoustical material in the area directly beneath the condensing section.
- Select acoustical material that discourages microbial growth.
- Minimize system static pressure losses to reduce fan sound generation.
- Design duct systems to minimize turbulence.
- Account for low frequency duct breakout in system design. Route the first 20 ft. of rectangular duct over non-sensitive areas and avoid large duct aspect ratios. Consider round or oval duct to reduce breakout.

There are many sound sources in rooftop systems. Fans, compressors, condenser fans, duct take-offs, etc., all generate sound. For guidelines on reducing sound generation in the duct system, refer to the ASHRAE Applications Handbook.

Contact your local McQuay sales representative for equipment supply, return and radiated sound power data specific to your application.

Ductwork Considerations

A well-designed duct system is required to allow the rooftop equipment to provide rated performance and to minimize system resistance and sound generation. Duct connections to and from units should allow straight, smooth airflow transitions. Avoid any abrupt change in duct size and sharp turns in the fan discharge. Avoid turns opposed to wheel rotation since they generate air turbulence and result in unwanted sound. If 90° turns are necessary, use turning vanes. Refer to the ASHRAE Applications Handbook for specific guidelines relevant to rooftop equipment.

Return Duct

The return path is the most often overlooked. A section of return duct is required to avoid a “line of sight” to the return air opening and to provide attenuation of return air sound. Install an insulated tee with a maximum duct velocity of 1000 to 1200 feet per minute. Extend the duct 15 feet to provide adequate attenuation.

Supply Duct

Insulate supply air ductwork for at least the first 20 feet from the unit. Consider the use of round or oval ductwork, as it significantly reduces low frequency breakout noise near the equipment. If rectangular duct is used, keep the aspect ratio of the duct as low as possible. The large flat surfaces associated with high aspect ratios increase low frequency breakout to the space and can generate noise, such as “oil canning.” The maximum recommended supply duct velocity is 1800 to 2000 feet per minute.

Duct High Limit

A McQuay Packaged System with VAV control includes a duct high limit switch as a standard feature that is of particular importance when fast acting, normally closed boxes are used.

Vibration Isolation

Make duct attachments to the unit with a flexible connection.

Economizer and Exhaust Fan Application

Rooftop economizer applications usually require exhaust fans to properly control building pressure and maintain minimum ventilation.

The air balancer must adjust the outdoor air damper to provide minimum ventilation settings.

The EAF is normally off during non-economizer operation. During these minimum outdoor air conditions, the system essentially acts like a supply fan only system.

Smoke and Fire Protection

Due to the wide variation in building design and ambient operating conditions into which our units are applied, we do not represent or warrant that our products are fit and sufficient for smoke, fume, and fire control purposes. The owner and a fully qualified building designer are responsible for meeting all local and NFPA building code requirements with respect to smoke, fume, and fire control.

The unit's control panel has a terminal block that a supply air and return air smoke detector can be wired to. An optional return air smoke detector is offered. Any other smoke detector, its installation, and the wiring to the unit controller are all field supplied.

Variable Air Volume Application

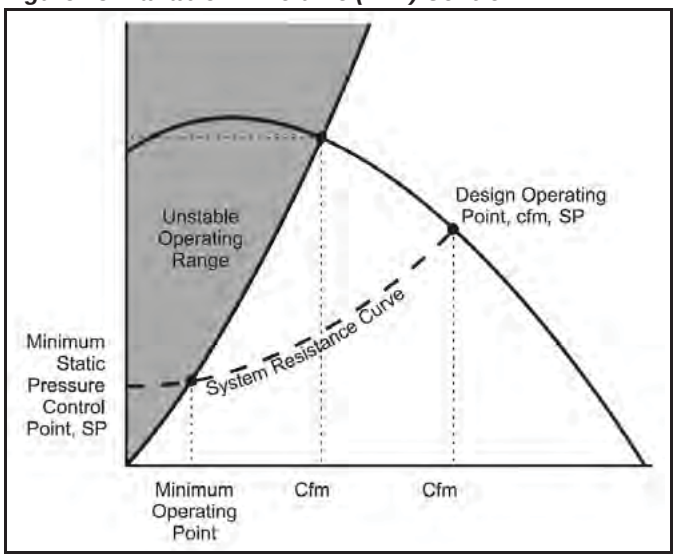
MPS units are available with variable speed drives to provide variable air volume (VAV) control as shown in Figure 13.

McQuay MPS variable air volume systems (VAV) employ the concept of varying the air quantity to a space at a constant temperature, thereby balancing the heat gains or losses and maintaining the desired room temperature. This ability to reduce supply air quantities not only provides substantial fan energy savings at partial load conditions, but it also minimizes equipment sizing.

Variable volume systems offer the following advantages:

- Lower system first cost by using system diversity to reduce equipment and duct sizes.
- Lower operating costs by reducing fan energy demands, especially at part load conditions.
- Acoustical sound performance is reduced at the lower airflows.

Figure 13: Variable Air Volume (VAV) Control



In placing a duct static pressure sensor, locate a pressure tap near the end of the main duct trunk. Adjust the static pressure set point so that at minimum airflow all of the terminals receive the minimum static pressure required plus any downstream resistance. Locate the static pressure sensor tap in the ductwork in an area free from turbulence effects and at least ten duct diameters downstream and several duct diameters upstream from any major interference, including branch takeoffs.

Fan Isolation

All McQuay MPS systems feature internally isolated fans. All supply fans are statically and dynamically balanced in the factory. 15–50 ton unit springs have 1" deflection and 62–75 ton unit springs have 2" deflection. Flexible isolation is provided as standard between the fan and bulkhead to prevent hard contact and vibration transmission.

When using an isolation curb, consult with the curb manufacturer to confirm no resonant vibration situation can occur between the fan and roof curb.

Normally, 15–50 ton unit springs are left in the tied down position. Optional rubber and shear isolators should be ordered for 62–75 ton units.

Fan Operating Range

The acceptable system operating range of the McQuay rooftop is determined by all of the following characteristics. Each of these limiting factors must be considered for proper performance and component design life:

- Unstable fan operation.
- Maximum fan rpm.
- Maximum cabinet static pressure.
- Maximum face velocity (cooling coil is most important).
- Minimum furnace velocity.
- Turndown capability on VAV applications.
- Compressor operating pressures.

Indoor Fan and Motor Heat

The indoor fan and motor electrical consumption is a sensible cooling load approximately equal to 2.8 MBh per bhp (depending slightly on motor efficiency). The fan and motor temperature rise is equal to Btuh/(1.08 × cfm) and is typically about 3°F.

Altitude Adjustments

Fan Curve Performance

Fan curve performance is based on 70°F air temperature and sea level elevation. Selections at any other conditions require adjustment for air densities listed in Table 2. Higher elevations generally require more rpm to provide a given static pressure but less bhp due to the decrease in air density.

Example:

Assume 12,000 cfm is required at 2.0" TSP. The elevation is 5000 ft. and 70°F average air temperature is selected. A 24" SWSI airfoil fan is selected.

1. The density adjustment factor for 5000 ft. and 70°F is 0.83.
2. TSP must be adjusted as follows: 2.0" / 0.83 = 2.4".
3. Locate 12,000 cfm and 2.4 on the fan curve. Rpm = 1700 and bhp = 9.
4. Consumed fan power at design = 9 bph × 0.83 = 7.5 bhp.

Table 2: Temperature and Altitude Conversion Factors

Air temp (°F)	Altitude (feet)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
-20	1.20	1.16	1.12	1.08	1.04	1.00	0.97	0.93	0.89
0	1.15	1.10	1.08	1.02	0.99	0.95	0.92	0.88	0.85
20	1.11	1.06	1.02	.098	0.95	0.92	0.88	0.85	0.82
40	1.06	1.02	0.98	0.94	0.91	0.88	0.84	0.81	0.78
60	1.02	0.98	0.94	0.91	0.88	0.85	0.81	0.79	0.76

Table 2: Temperature and Altitude Conversion Factors

Air temp (°F)	Altitude (feet)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
70	1.00	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74
80	0.98	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72
100	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.70
120	0.92	0.88	0.85	0.81	0.78	0.76	0.72	0.70	0.67
140	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.78	0.65

Condenser Performance

Altitudes greater than sea level require a derate in condenser and cooling performance that can be estimated as follows:

For altitudes up to 6000 feet:

- Cooling capacity decrease factor (all sizes) = 0.5% per 1000 feet.
- Compressor kW increase factor = 0.6% per 1000 feet.

For altitudes above 6000 feet, consult the factory. The actual derate varies with each individual unit and design conditions. Your local McQuay representative can provide exact performance data.

Furnace Performance

Gas heat performance data is based on standard 70°F air temperature and zero feet altitude (sea level).

For altitudes between 2000 to 6000 feet, the gas burner must be derated 4% for every 1000 feet of altitude.

Example:

A 400 MBh furnace at an altitude of 3000 feet is derated (0.04 × 3 = 0.12). At 400 MBh input (400 × 0.12 MBh), the actual input is (400 - 48 = 352 MBh) at 3000 feet.

For altitudes above 6000 feet, consult the factory.

System Operating Limits

McQuay MPS systems are designed to operate over an extensive operating range. However, for proper system operation some limits do apply.

To help prevent moisture blow-off, design guidelines have been established for cooling coil selection. Based on laboratory testing, average coil face velocities should not exceed 600 ft./min. For applications outside of these limits, consult your McQuay sales representative.

In addition to maximum face velocity limitations, minimum velocity guidelines must also be followed. In order to maintain proper refrigeration performance, the minimum coil face velocity is 175 ft./min. When selecting a variable air volume unit, it is necessary to design the system such that the 175 ft./min. limit is maintained at light load conditions.

Application Considerations

Condensate Drainage

Provide all drain pans with a properly sized p-trap to allow free drainage of coil condensate. For trap sizing, follow instruction given in IM 842. Run all traps and drain lines full size from the threaded unit connection to the roof drain.

Zone Sensor Placement

Placement of the zone temperature sensor is critical for proper and economical operation of the heating and cooling system. It is generally recommended that the space sensor be located on an inside wall (3 to 5 feet from an outside wall) in a space having a floor area of at least 400 square feet. Do not locate the sensor below the outlet of a supply diffuser, in the direct rays of the sun, on a wall adjacent to an unheated or abnormally warm room (boiler or incinerator room), or near any heat producing equipment. Where zone sensor placement is a problem, all zone control systems, as standard, have the capability to use a return air sensor for heating and cooling.

Unit Wiring

All units require three phase, 60 Hz, 208, 230, 460, or 575 volt power supply. All units include branch circuits and short circuit protection and are available with a power block or non-fused disconnect switch. Each unit is provided with a 115 V convenience outlet. Per the NEC, this circuit must be fed independent of the main unit power supply.

All wiring must be installed in accordance with the National Electric Code (NEC) and local codes.

Winter Shipment

Flat bed shipment in winter can expose units to harsh road chemicals. Since equipment size and configuration precludes covering during transit, wash units free of these chemicals as soon as possible to help prevent corrosion.

Coil Freeze Protection

When applying roof-mounted equipment in areas that experience subfreezing conditions, coil freeze protection measures must be provided. Subfreezing temperatures can adversely affect water and steam coils during controlled or uncontrolled unit shutdowns and even during unit operation. McQuay economizer dampers are arranged to direct the outside and return air streams toward each other, however, there may not always be a uniform unit temperature profile under all load and ambient temperatures. Some temperature stratification will occur, particularly at low ambient temperatures and the associated reduced airflow inherent with VAV systems.

Glycol is strongly recommended as a positive means of freeze protection for water coils. No control sequence can prevent coil freezing in the event of a power failure or equipment malfunction. During those periods, glycol is the only positive means of freeze protection. When selecting water coils, specify glycol to account for performance differences.

Freeze protection control strategies must be designed to keep unit cabinet temperatures from exceeding 150°F during a unit shutdown. Temperatures in excess of 150°F may exceed the design limits of motors, electrical components, gaskets, etc. potentially leading to premature failure of components.

Achieving Optimal Performance

Achieving the optimal performance of a rooftop system requires both accurate system design and proper equipment selection. Factors that control the unit selection include applicable codes, ventilation and air filtration requirements, heating and cooling loads, acceptable temperature differentials, and installation limitations.

The McQuay SelectTools™ software selection program allows your local McQuay sales representative to provide you with fast, accurate and complete selection of McQuay MPS units. You also can select your unit through reference to physical, performance, dimensional, and unit weight data included in this catalog.

To properly select unit equipment:

1. Select unit size and cooling coil.
2. Select heating coils and equipment.
3. Select fans and motors.

Below are examples that illustrate the equations and catalog references used in the unit selection process.

Table 3: Selection Example

A constant volume system with DX cooling and natural gas heat is required to meet the following criteria:

Supply air volume =	14,000 cfm
Return air volume =	11,200 cfm
Minimum outside air volume =	2800 cfm
Maximum face velocity =	550 fpm
Supply ductwork external SP =	1.50-in. w.g.
Return ductwork external SP =	0.50-in. w.g.
Altitude =	Sea level
Economizer =	Required
30% throw-away filters =	Required
Voltage =	460 V/60 Hz/3 Ph
Natural gas heat =	Required
Double-wall construction =	Required

Summer design:

Mixed air temperature =	80°F/67°F
Total sensible load =	345,000 Btu/hr
Total load =	450,000 Btu/hr
Space supply air temperature =	60°F
Ambient conditions =	95°F/76°F
Est. supply fan sensible heat rise = (included in above sensible load)	3°F

Winter design:

Return air temperature =	70°F
Ambient temperature =	10°F
Space heating load =	315,000 Btu/hr

Selecting Unit Size to Satisfy Summer Design

Unit size is based on coil face area and cooling capacity requirements. Supply air capacity and maximum face velocity constraints should serve as a guide for selecting coil dimensions and cabinet size.

Based on the given data in Table 3, the appropriate coil face area may be determined as follows:

Minimum face area = supply air volume/max. face velocity
= 14,000 cfm/550 fpm
= 25.5 square feet

Note: Unit data is based on standard air conditions of 70°F at sea level. Refer to Application Considerations, page 20 for temperature/altitude conversion factors for nonstandard conditions.

Referring to Physical Data, page 27, the 29.4 square foot coil of the MPS 040A unit satisfies the required face velocity.

Using the Performance Data, page 30, the unit selection is an MPS 040A. Unit performance equals 457,000 Btu/hr. total, 350,000 Btu/hr. Sensible.

Supply air dry bulb =
80°F – 350 MBh/(1.085 × 14,000 cfm) = 57.0°F

Once the initial unit selection is made, determine the actual supply fan heat rise and check and verify the selection for net capacity and supply air temperature.

Selecting the Unit Heating System

Heating equipment and coils can be specified directly from figures and tables incorporated in Hot Water Heating Capacity, page 36.

Calculating Total Heating Load

Total heating load = space heating load + outdoor air load – supply fan heat

From the data given in Table 3, the outdoor air load is (1.085 × 2800)
(70 – 10) / 1000 = 182 MBh and supply fan heat is 46 MBh.

Total heat load = 315 MBh + 182 MBh – 46 MBh = 451 MBh

Selecting Fans and Motors

Fan and motor selections are based on total static pressure drop and design airflow. Total static pressure includes internal air pressure drops of unit components and external air pressure drops in supply and return ducts. Refer to Pressure Drops, page 38 for internal pressure drops of unit components.

When selecting unit fans and motors, use the fan curves provided in Figure 31, page 49 and Figure 32, page 49.

Select the motor size most closely above the application brake horsepower. (Example: For an application brake horsepower of 7 bhp, select a 7.5 hp motor). An oversized motor (large horsepower to load ratio) can greatly increase electric consumption due to the reduction in motor performance.

Exhaust Fan and Motor

Exhaust fans must be sized for maximum exhaust cfm and return duct ESP at those conditions. See Hot Water Pressure Drop Curves, page 45 for more information.

Supply Fan and Motor

Since the system in Table 3 includes a return fan, the return duct static pressure drop is not added to the supply fan pressure drop. Therefore, the total static pressure for the supply fan in Table 3 is as follows:

Internal pressure drops:

0–100% economizer, with RAF = 0.17-in. w.g.
30% filters = 0.13-in. w.g.
Evaporative coil = 0.61-in. w.g.
Total internal pressure drop = 1.16-in. w.g.

External pressure drops:

Supply duct = 1.50-in. w.g.
Return duct = 0.50-in. w.g.
Total external pressure drop = 2.00-in. w.g.

Total static pressure = internal drops + external drops
= 1.16 + 2.00
= 3.16-in. w.g.

Entering the MPS 040A fan curve at 14,000 cfm and 3.16-in. w.g., the required fan motor size is 15 hp operating at 1325 rpm. Fan brake horsepower is 12.9 horsepower.

The total fan and motor heat for the supply fan is as follows:

(12.9) bhp × 2.8 MBh/bhp = 36 MBh

Additional Weights When Selecting Motors

Table 4 and Table 5 lists additional weights when selecting a motor and exhaust fan. See Unit Capacity and Physical Data, page 27 for base unit weights, capacities and physical data.

Table 4: Additional Weights When Selecting Motors/ Exhaust Fans (015–025 units)

HP	Additional Motor Weight (lbs)
1	0
1.5	9
2	9
3	32
5	43

Unit tons	Additional Exhaust Fan Weight (lbs)
15	150
17	150
25	150

Table 5: Additional Weights When Selecting Motors/ Exhaust Fans (030–050 units)

HP	Additional Motor Weight (lbs)
7.5	0
10	25
15	125
20	175
25	225
30	275

Unit tons	Additional Exhaust Fan Weight (lbs)
30	150
35	150
40	200
50	200

Note: See Table 44, page 85 for additional weights on 62–75 ton units.

Supply Power Wiring for Units Without Electric Heat

Sizing supply power wire for a unit is based on the circuit with the largest amperage draw. All electrical equipment is wired to a central panel for single or optional multipower connections. Refer to Electrical Data, page 86 for FLA and RLA ratings of equipment. Determination of Minimum Circuit Ampacity (MCA) for a 460 V unit with standard condenser fans and R-410A is as follows:

Fans and Cooling

MCA = 1.25 × (RLA or FLA of largest motor) + FLA of all other loads

Example: **FLA/RLA**

Compressor 1, 2, 3 = 16.5, 16.5, 14 amps
Condenser fan motors, (3) 1 hp = 2 amps ea.
Supply fan motor, 15 hp = 17.7 amps
Controls = 1 amps

Therefore,

MCA = (1.25 × 17.7) + 16.5 + 16.5 + 14.0 + (3 × 2) + 1
= 76 amps

Note: In the above example, the selected power supply wire is based on 90 amperes.

Unit Capacity and Physical Data

Table 6: MPS 015–025

Model	MPS		
	015	017	025
Cooling Performance			
Gross cooling capacity (tons)	16.0	18.5	25.3
Nominal airflow (cfm)	6000	7000	10,000
EER	11.0	11.0	10.0
IEER (CAV-VAV)	11.3-11.5	11.3-11.9	11.0-11.2
Gas Heating Performance			
Low heat MBH (input/output)[1]	240/192	240/192	240/192
Number of stages (low heat)	2	2	2
Turndown (low heat)[2]	4:1	4:1	4:1
Gas connection pipe size/qty (low heat)	3/4"/1	3/4"/1	3/4"/1
High heat MBH (input/output)[1]	480/384	480/384	480/384
Number of stages (high heat)	4	4	4
Turndown (high heat)[2]	8:1	8:1	8:1
Steady state efficiency	80%	80%	80%
Hot Water Heating Performance			
Face area (sq ft)	12.2	12.2	12.25
Rows/FPI (low heat)	1/11	1/11	1/14
Coil model (low heat)	5WB	5WB	5WB
Connection sizes/type (low heat)[2]	ODM Sweat	ODM Sweat	ODM Sweat
Rows/FPI (high heat)	2/12	2/12	2/9
Coil model (high heat)	5WB	5WB	5WS
Connection sizes/type (high heat)[2]	ODM Sweat	ODM Sweat	ODM Sweat
Electric Heating Performance			
Number of stages	4	4	4
kW (low/medium/high heat)	18/36/54	18/36/54	36/54/72
Compressors			
Type/number	Scroll/2	Scroll/2	Scroll/3
Number of stages	2	2	5
Charge (lbs)	Ckt1 - 9.0/Ckt2 - 9.0	Ckt1 - 9.0/Ckt2 - 10.0	Ckt1 - 11.0/Ckt2 - 12.5
Evaporator Coils			
Rows/FPI	4/14	4/14	4/13
Face area (sq ft)	18.2	18.2	18.2
Capacity control	TXV	TXV	TXV
Hot Gas Reheat			
Coil type	Microchannel	Microchannel	Microchannel
Control type	Modulating	Modulating	Modulating
Face area (sq ft)	14.1	14.1	14.1
Minimum temperature rise	20°	20°	20°
Condenser Coils			
Fin type	Enhanced	Enhanced	Enhanced
FPI	18	18	18
Face area (sq ft)	36.2	36.2	36.2
Outdoor Fans			
Type	Propeller	Propeller	Propeller
Number - diameter	2 - 26"	2 - 26"	2 - 26"
Drive type/number of speeds	Direct/1	Direct/1	Direct/1
Indoor Fans			
Type	AF - SWSI	AF - SWSI	AF - SWSI
Number - diameter	1 - 18"	1 - 20"	1 - 22"
Drive type	Fixed sheave	Fixed sheave	Fixed sheave
Isolation	1" spring	1" spring	1" spring
Number of motors	1	1	1
Motor hp range	1.5 - 10	1.5 - 10	2 - 15
Motor nominal rpm	1800	1800	1800
Motor efficiency	Premium	Premium	Premium
Filters			
Type	2", MERV 7		
Area (sq ft)	24	24	24
Qty. - size	6 - 24" x 24"	6 - 24" x 24"	6 - 24" x 24"

Note: [1] Based on 200 cfm/ton @ 95/78 DX coil EAT.
[2] Piping connections are given with a male outside diameter dimension, brazed connection.

Physical Data

Table 7: MPS 030–050

Model	MPS			
	030	035	040	050
Cooling Performance				
Gross cooling capacity (tons)	30.0	34.0	40.0	50.0
Nominal airflow (cfm)	12,000	14,000	16,000	20,000
EER	10.3	10.0	10.2	10.0
IEER (CAV-VAV)	12.4-13.0	11.9-12.3	12.0-12.6	11.6-12.2
Gas Heating Performance				
Low heat MBH (input/output)[1]	300/240	300/240	400/320	400/320
Number of stages (low heat)	2	2	2	2
Turndown (low heat)[2]	4:1	4:1	4:1	4:1
Gas connection pipe size/qty (low heat)	3/4"/1	3/4"/1	3/4"/1	3/4"/1
High heat MBH (input/output)[1]	600/480	600/480	800/640	800/640
Number of stages (high heat)	4	4	4	4
Turndown (high heat)[2]	8:1	8:1	8:1	8:1
Steady state efficiency	80%	80%	80%	80%
Hot Water Heating Performance				
Face area (sq ft)	19.25	19.25	19.25	19.25
Rows/FPI (low heat)	1/12	1/12	1/11	1/11
Coil model (low heat)	5WB	5WB	5WH	5WH
Connection sizes/type (low heat)[2]	ODM Sweat	ODM Sweat	ODM Sweat	ODM Sweat
Rows/FPI (high heat)	2/10	2/10	2/13	2/13
Coil model (high heat)	5WS	5WS	5WS	5WS
Connection sizes/type (high heat)[2]	ODM Sweat	ODM Sweat	ODM Sweat	ODM Sweat
Electric Heating Performance				
Number of stages	4	4	4	4
kW (low/medium/high heat)	54/72/90	54/72/90	72/90/108	72/90/108
Compressors				
Type/number	Scroll/3	Scroll/3	Scroll/4	Scroll/4
Number of stages	5	5	5	5
Charge (lbs)	Ckt1 - 19/ Ckt2 - 10.2	Ckt1 - 19/ Ckt2 - 10.5	Ckt1 - 21.5/Ckt2 - 12.5	Ckt1 - 21.5/Ckt2 - 22
Evaporator Coils				
Rows/FPI	4/12	4/12	4/12	4/12
Face area (sq ft)	25.4	25.4	35.7	35.7
Capacity control	TXV	TXV	TXV	TXV
Hot Gas Reheat Coils				
Coil type	Microchannel	Microchannel	Microchannel	Microchannel
Control type	Modulating	Modulating	Modulating	Modulating
Face area (sq ft)	19.9	19.9	26.8	26.8
Minimum temperature rise	20°	20°	20°	20°
Condenser Coils				
Fin type	Enhanced	Enhanced	Enhanced	Enhanced
FPI	18	18	18	18
Face area (sq ft)	41.2	41.2	74.7	74.7
Outdoor Fans				
Type	Propeller	Propeller	Propeller	Propeller
Number - diameter	3 - 26"	3 - 26"	4 - 26"	4 - 26"
Drive type/number of speeds	Direct/1	Direct/1	Direct/1	Direct/1
Indoor Fans				
Type	AF - SWSI	AF - SWSI	AF - SWSI	AF - SWSI
Number - diameter	1 - 24"	1 - 24"	1 - 30"	1 - 30"
Drive type	Fixed sheave	Fixed sheave	Fixed sheave	Fixed sheave
Isolation	1" spring	1" spring	1" spring	1" spring
Number of motors	1	1	1	1
Motor hp range	5 - 20	5 - 20	7-1/2 - 30	7-1/2 - 30
Motor nominal rpm	1800	1800	1800	1800
Motor efficiency	Premium	Premium	Premium	Premium
Filters				
Type	2", MERV 7			
Area (sq ft)	32	32	44	44
Qty. - size	8 - 24" x 24"	8 – 24" x 24"	8 – 24" x 24"/4 – 18" x 24"	8 – 24" x 24"/4 – 18" x 24"

Note: [1] Based on 200 cfm/ton @ 95/78 DX coil EAT.
[2] Piping connections are given with a male outside diameter dimension, brazed connection.

Table 8: MPS 062–075

Model		MPS		
		062	070	075
Cooling Performance				
Nominal gross cooling capacity (tons)		62.0	70.0	75.0
Nominal airflow (cfm)		24,000	26,000	28,000
EER (standard coil/large coil)		10.0/10.1	9.7	9.4
IEER		12.2/12.3	13.6	12.9
Gas Heating Performance				
Low heat MBH (input/output)[1]		500/400	500/400	500/400
Gas connection pipe size/qty (low heat)		1"/1	1"/1	1"/1
Medium heat MBH (input/output)[1]		600/480	600/480	800/640
Gas connection pipe size/qty (medium heat)		1 1/4"/1	1 1/4"/1	1 1/4"/1
High heat MBH (input/output)[1]		980/790	980/790	980/790
Number of stages - all furnaces (high heat)		Mod	Mod	Mod
Turndown - all furnaces (high heat)[2]		3:1	3:1	3:1
Steady state efficiency - all furnaces		80%	80%	80%
Hot Water Heating Performance				
Face area (sq ft)		29.7	29.7	29.7
Type–rows (standard / high capacity)		5WH–1 / 5WS–2	5WH–1 / 5WS–2	5WH–1 / 5WS–2
FPI		9	9	9
Electric Heating Performance				
Number of stages		4	4	4
kW (low/medium/high heat)		100/120/160	100/120/160	100/120/160
Compressors				
Type/number		Scroll/4	Scroll/6	Scroll/6
Number of stages		4	6	6
Charge (lbs)		Ckt1 - 33/Ckt2 - 33	Ckt1 - 36/Ckt2 - 36	Ckt1 - 36/Ckt2 - 36
Evaporator Coils				
Rows/FPI		5/10	5/10	5/10
Face area (sq ft)		39.5 or 47.1	47.1	47.1
Capacity control		TXV	TXV	TXV
Condenser Coils				
Fin type		Enhanced	Enhanced	Enhanced
FPI		18	18	18
Face area (sq ft)		32.1 × 2	37.3 × 2	37.3 × 2
Outdoor Fans				
Type		Propeller	Propeller	Propeller
Number - diameter		6 - 26"	6 - 26"	8 - 26"
Drive type/number of speeds		Direct/1	Direct/1	Direct/1
Indoor Fans				
SWSI AF		1 - 44"		
DWDI AF		1 - 30" or 1 - 33"		
Drive type		Fixed sheave		
Isolation		2" spring		
Number of motors		1		
Motor hp range		5 - 40		
Motor nominal rpm		1800		
Motor efficiency		Premium		
Filters				
Qty. - type / sq. ft.	Merv 7 angular	(7) 16 × 20 and (21) 16 × 25 / 73 sq. ft.		
	6" Merv 11 or 12" Merv 14	(4) 12 × 24 and (8) 24 × 24 / 40 sq. ft. standard air flow (8) 12 × 24 and (8) 24 × 24 / 48 sq. ft. high air flow		

Note: [1] Piping connections are given with a male outside diameter dimension, brazed connection.

Note: [2] Heating output is for standard conditions at sea level.

Cooling Capacity

Table 9: MPS 015 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
6000	75	61	183	163	10.8	175	159	12.1	166	155	13.5	157	151	15.0
		67	203	122	10.8	192	118	12.1	182	114	13.6	172	111	15.1
		73	-	-	-	214	77	12.2	203	73	13.6	191	69	15.1
	80	61	189	189	10.8	182	182	12.1	174	174	13.5	166	166	15.1
		67	203	155	10.8	193	151	12.1	183	147	13.6	173	144	15.1
		73	-	-	-	-	-	-	202	106	13.6	191	102	15.1
	85	61	201	201	10.8	193	193	12.1	185	185	13.5	176	176	15.1
		67	205	188	10.9	196	184	12.1	186	179	13.6	177	173	15.1
		73	-	-	-	213	142	12.2	202	139	13.6	191	135	15.1
5250	75	61	179	152	10.8	171	148	12.1	162	144	13.5	154	140	15.0
		67	199	115	10.8	189	112	12.1	179	108	13.5	170	104	15.1
		73	-	-	-	210	75	12.2	199	71	13.6	188	68	15.1
	80	61	183	179	10.8	175	173	12.1	167	167	13.5	160	160	15.0
		67	199	144	10.8	189	141	12.1	180	137	13.5	170	133	15.1
		73	-	-	-	-	-	-	100	100	13.6	188	96	15.1
	85	61	192	192	10.8	185	185	12.1	177	177	13.5	169	169	15.1
		67	200	173	10.8	191	170	112.1	181	166	13.5	172	162	15.1
		73	-	-	-	210	133	12.2	199	129	13.6	188	125	15.1
4125	75	61	171	133	10.8	163	130	12.1	156	126	13.4	147	122	15.0
		67	-	-	-	181	101	12.1	173	97	13.5	164	94	15.0
		73	-	-	-	203	72	12.2	193	69	13.6	182	65	15.1
	80	61	172	156	10.8	165	153	12.1	157	149	13.5	149	145	15.0
		67	191	128	10.8	182	124	12.1	173	120	13.5	164	117	15.0
		73	-	-	-	-	-	-	-	-	-	-	-	-
	85	61	177	176	10.8	170	170	12.1	164	164	13.5	157	157	15.0
		67	191	150	10.8	182	147	12.1	174	143	13.5	164	139	15.1
		73	-	-	-	-	-	-	-	-	-	-	-	-

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 10: MPS 017 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
7000	75	61	211	188	12.9	202	184	14.3	192	179	15.9	182	174	17.6
		67	232	141	13.1	221	136	14.5	210	132	16.1	199	128	17.8
		73	257	92	13.3	-	-	-	-	-	-	-	-	-
	80	61	218	218	13.0	210	210	14.4	202	202	16.0	192	192	17.7
		67	232	179	13.1	222	175	14.5	211	170	16.1	200	166	17.8
		73	257	130	13.3	-	-	-	-	-	-	-	-	-
	85	61	231	231	13.1	223	223	14.5	214	214	16.1	204	204	17.9
		67	236	217	13.1	226	212	14.6	215	207	16.1	204	201	17.9
		73	257	169	13.3	-	-	-	-	-	-	-	-	-
6125	75	61	206	175	12.8	197	171	14.3	188	167	15.8	178	162	17.6
		67	228	133	13.1	217	129	14.5	207	125	16.0	196	120	17.8
		73	252	90	13.3	242	86	14.7	-	-	-	-	-	-
	80	61	210	207	12.9	203	201	14.3	194	194	15.9	185	185	17.6
		67	228	167	13.1	218	163	14.5	207	158	16.0	196	154	17.8
		73	253	124	13.3	241	120	14.7	-	-	-	-	-	-
	85	61	222	222	13.0	214	214	14.4	206	206	16.0	196	196	17.8
		67	230	200	13.1	220	196	14.5	210	192	16.1	199	187	17.8
		73	253	157	13.3	241	153	14.7	-	-	-	-	-	-
4812	75	61	197	154	12.7	189	150	14.2	180	146	15.7	170	142	17.5
		67	219	121	13.0	209	117	14.4	200	113	16.0	189	108	17.7
		73	244	87	13.2	233	83	14.6	222	79	16.2	210	75	18.0
	80	61	199	181	12.8	191	177	14.2	182	173	15.7	173	168	17.5
		67	219	147	13.0	210	143	14.4	200	139	16.0	189	135	17.7
		73	243	113	13.2	233	109	14.6	222	105	16.2	210	101	18.0
	85	61	204	204	12.8	197	197	14.2	190	190	15.8	182	182	17.6
		67	220	174	13.0	211	170	14.4	201	166	16.0	190	162	17.7
		73	244	140	13.2	233	136	14.6	222	132	16.2	210	128	18.0

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 11: MPS 025 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
10,000	75	61	296	264	20.8	283	258	23.1	268	251	25.7	252	243	28.7
		67	325	197	21.4	310	191	23.7	293	185	26.3	275	178	29.2
		73	359	128	22.0	342	123	24.3	324	117	26.9	304	110	29.9
	80	61	305	305	21.0	293	293	23.3	280	280	26.0	266	266	29.0
		67	325	251	21.4	310	245	23.7	294	239	26.3	276	232	29.2
		73	358	182	22.0	341	176	24.3	323	170	27.0	303	164	29.9
	85	61	322	322	21.3	310	310	23.7	296	296	26.3	281	281	29.4
		67	328	303	21.4	314	296	23.8	298	289	26.4	281	279	29.4
		73	358	236	22.0	341	230	24.3	324	224	26.9	304	218	29.9
8750	75	61	290	247	20.7	277	240	23.0	263	234	25.6	247	227	28.5
		67	319	187	21.3	305	181	23.6	289	175	26.2	271	168	29.1
		73	353	126	21.9	337	120	24.2	319	114	26.8	300	108	29.8
	80	61	295	291	20.8	283	282	23.1	271	271	25.8	257	257	28.8
		67	319	234	21.3	305	228	23.6	289	222	26.2	272	215	29.1
		73	352	173	21.9	336	167	24.2	318	161	26.8	299	155	29.8
	85	61	310	310	21.1	299	299	23.4	286	286	26.1	271	271	29.1
		67	321	281	21.3	307	275	23.6	292	268	26.2	274	261	29.2
		73	352	220	21.9	336	215	24.2	319	209	26.8	300	202	29.8
6875	75	61	278	218	20.5	266	212	22.8	252	206	25.4	237	199	28.3
		67	308	170	21.0	294	165	23.3	279	158	26.0	262	152	28.9
		73	341	121	21.6	326	116	24.0	309	110	26.6	291	104	29.6
	80	61	279	256	20.5	268	250	22.8	255	243	25.4	240	235	28.4
		67	307	208	21.0	294	202	23.4	279	196	26.0	262	189	28.9
		73	341	159	21.6	325	153	24.0	309	147	26.6	291	141	29.6
	85	61	287	287	20.7	276	276	23.0	265	265	25.7	253	253	28.7
		67	308	245	21.0	295	240	23.4	280	234	26.0	264	227	29.0
		73	340	196	21.7	325	191	24.0	308	185	26.6	290	178	29.6

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 12: MPS 030 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
12,000	75	61	360	318	22.7	343	311	25.0	326	302	27.7	307	291	30.9
		67	398	239	23.3	379	232	25.7	359	224	28.3	337	216	31.5
		73	441	158	24.0	420	151	26.4	397	143	29.0	373	135	32.2
	80	61	368	221	22.8	353	353	25.2	338	338	27.9	321	321	31.2
		67	398	303	23.3	379	295	25.7	359	288	28.4	337	279	31.5
		73	440	221	24.0	420	214	26.4	397	207	29.0	373	199	32.2
	85	61	388	388	23.2	374	374	25.6	357	357	28.3	340	340	31.5
		67	399	364	23.4	381	356	25.7	362	345	28.4	343	333	31.6
		73	439	285	24.0	419	278	26.4	396	270	29.0	372	262	32.2
10,500	75	61	352	297	22.6	336	290	24.9	319	282	27.6	301	273	30.8
		67	390	226	23.2	372	219	25.5	352	211	28.2	331	331	31.4
		73	433	154	23.9	413	147	26.2	391	140	28.9	367	132	32.0
	80	61	356	346	22.6	342	336	25.0	326	325	27.7	310	310	30.9
		67	390	283	23.2	373	276	25.5	353	268	28.2	332	260	31.4
		73	432	210	23.9	412	260	26.2	389	252	28.9	366	244	32.0
	85	61	373	373	22.9	359	359	25.3	344	344	28.1	327	327	31.3
		67	391	338	23.2	373	331	25.5	354	323	28.2	334	313	31.4
		73	432	267	23.9	412	260	26.2	389	252	28.9	366	244	32.0
8250	75	61	336	263	22.3	322	256	24.6	306	248	27.3	288	240	30.5
		67	373	206	22.9	357	199	25.3	340	192	28.0	320	184	31.2
		73	416	148	23.6	397	141	26.0	377	134	28.7	355	126	31.8
	80	61	337	307	22.3	323	300	24.6	307	291	27.4	291	281	30.6
		67	373	251	22.9	357	244	25.3	339	237	28.0	320	229	31.1
		73	415	193	23.6	397	186	26.0	377	179	28.6	355	171	31.8
	85	61	344	343	22.4	331	331	24.8	318	318	27.6	304	304	30.8
		67	374	296	22.9	358	289	25.3	340	281	28.0	320	273	31.1
		73	415	238	23.6	396	231	26.0	376	224	28.7	354	216	31.8

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 13: MPS 035 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
14,000	75	61	397	359	25.5	378	350	28.2	358	340	31.2	336	329	34.8
		67	438	267	26.3	417	259	28.9	394	251	31.9	370	242	35.5
		73	484	173	27.1	461	166	29.7	435	157	32.8	408	149	36.3
	80	61	408	408	25.8	392	392	28.5	374	374	31.6	355	355	35.2
		67	438	341	26.3	417	332	28.9	394	324	31.9	370	314	35.5
		73	484	247	27.1	460	239	29.7	435	231	32.8	408	222	36.3
	85	61	431	431	26.2	414	414	28.9	396	396	32.0	376	376	35.6
		67	440	412	26.3	419	402	29.0	398	392	32.0	376	376	35.6
		73	483	320	27.1	460	313	29.8	435	304	32.8	407	295	36.3
12,250	75	61	389	335	25.4	371	327	28.0	351	318	31.1	330	308	34.7
		67	429	253	26.2	409	245	28.8	388	236	31.8	364	228	35.4
		73	476	170	27.0	453	162	29.6	429	154	32.6	403	145	36.2
	80	61	393	393	25.5	378	378	28.2	361	361	31.3	343	343	35.0
		67	430	318	26.2	410	310	28.8	388	301	31.3	343	343	35.0
		73	476	235	27.0	453	227	29.6	429	219	32.6	402	210	36.2
	85	61	415	415	25.9	399	399	28.6	382	382	31.7	363	363	35.4
		67	430	382	26.2	411	374	28.8	389	364	31.8	366	354	35.4
		73	475	299	27.0	452	292	29.6	428	283	32.6	402	275	36.2
9625	75	61	373	296	25.1	357	288	27.7	338	280	30.8	318	271	34.4
		67	413	230	25.9	395	222	28.5	674	214	31.6	352	205	35.2
		73	459	163	26.7	438	156	29.3	415	148	32.4	390	139	35.9
	80	61	373	347	25.1	358	339	27.8	340	330	30.9	321	320	34.5
		67	413	282	25.9	395	274	28.5	374	266	31.6	353	257	35.2
		73	458	215	26.7	438	208	29.3	415	199	32.4	390	191	35.9
	85	61	384	384	25.3	370	370	28.0	355	355	31.2	338	338	34.9
		67	414	334	25.8	395	326	28.5	375	318	31.5	352	309	35.2
		73	458	267	26.7	437	259	29.3	414	251	32.3	389	242	35.9

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 14: MPS 040 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
16,000	75	61	442	404	27.7	421	394	30.6	399	382	33.9	377	367	37.7
		67	487	300	28.5	464	292	31.3	440	283	34.6	412	273	38.4
		73	539	194	29.4	513	185	32.2	485	176	35.4	455	166	39.2
	80	61	456	456	28.0	438	438	30.9	419	419	34.2	397	397	38.1
		67	487	384	28.5	465	376	31.3	439	366	34.6	413	355	38.4
		73	538	278	29.4	512	269	32.2	485	260	35.4	455	250	39.2
	85	61	482	482	28.4	463	463	31.3	443	443	34.6	421	421	38.5
		67	490	463	28.6	470	451	31.4	446	436	34.7	421	419	38.6
		73	537	361	29.4	512	353	32.2	484	344	35.4	454	334	39.2
14,000	75	61	432	377	27.6	413	368	30.4	392	358	33.7	368	347	37.6
		67	478	284	28.4	456	275	31.2	432	266	34.4	406	257	38.3
		73	530	189	29.2	505	181	32.0	478	172	35.3	449	162	39.1
	80	61	440	437	27.7	422	422	30.6	404	404	33.9	384	384	37.9
		67	479	359	28.4	457	350	31.2	432	341	34.5	406	330	38.3
		73	529	263	29.2	505	255	32.0	478	246	35.3	449	236	39.1
	85	61	464	464	28.1	447	447	31.0	428	428	34.4	406	406	38.3
		67	480	431	28.4	458	422	31.2	435	411	34.5	411	396	38.4
		73	529	338	29.2	504	329	32.0	477	320	35.3	448	310	39.1
11,000	75	61	415	333	27.2	397	325	30.1	377	316	33.4	355	306	37.3
		67	460	258	28.1	439	250	30.9	417	241	34.2	393	231	38.0
		73	511	182	28.9	488	174	31.7	463	165	35.0	436	155	38.8
	80	61	416	391	27.3	399	381	30.1	380	369	33.5	360	355	37.4
		67	460	318	28.0	440	309	30.9	417	300	34.2	393	290	38.0
		73	511	241	28.9	488	233	31.7	463	224	35.0	435	215	38.8
	85	61	430	430	27.5	414	414	30.4	397	397	33.8	379	379	37.8
		67	460	377	28.0	440	368	30.9	418	359	34.2	393	349	38.0
		73	510	300	28.9	487	292	31.7	461	283	35.0	434	274	38.8

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 15: MPS 050 Cooling Capacities (4 Row Coil)

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)											
			85°			95°			105°			115°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
20,000	75	61	568	512	38.0	540	499	42.0	512	486	46.6	480	470	52.0
		67	625	381	39.2	595	370	43.1	563	358	47.6	528	345	53.0
		73	691	248	40.5	657	236	44.4	621	224	48.9	582	212	54.2
	80	61	583	583	38.4	560	560	42.4	534	534	47.1	506	506	52.6
		67	626	486	39.2	596	475	43.1	563	462	47.7	528	448	53.0
		73	691	352	40.5	657	341	44.4	620	329	48.9	581	316	54.2
	85	61	616	616	39.1	592	592	43.1	566	566	47.7	537	537	53.2
		67	628	587	39.3	599	574	43.2	567	559	47.8	537	537	53.2
		73	689	457	40.5	656	446	44.4	620	434	48.9	580	421	54.3
17,500	75	61	557	479	37.8	531	467	41.7	502	453	46.3	470	439	51.8
		67	614	361	39.0	585	349	42.9	553	337	47.5	520	325	52.8
		73	680	242	40.2	647	231	44.2	612	219	48.7	574	207	54.0
	80	61	563	562	37.9	540	540	42.0	516	516	46.7	490	490	52.2
		67	615	454	39.0	585	443	42.9	554	430	47.5	519	417	52.8
		73	679	335	40.2	647	324	44.2	611	312	48.7	573	299	54.0
	85	61	593	593	38.6	570	570	42.6	545	545	47.3	518	518	52.8
		67	615	545	39.0	587	533	43.0	556	520	47.5	523	506	52.9
		73	678	427	40.2	644	416	44.2	610	404	48.7	572	392	54.1
13,750	75	61	534	423	37.3	510	412	41.3	483	400	45.9	455	387	51.4
		67	591	329	38.5	564	318	42.5	534	306	47.1	502	293	52.5
		73	656	233	39.8	625	222	43.7	592	211	48.3	556	198	53.7
	80	61	534	496	37.3	511	485	41.3	486	472	46.0	458	456	51.5
		67	591	403	38.5	564	392	42.5	534	380	47.1	503	367	52.5
		73	655	307	39.8	625	296	43.7	592	285	48.3	556	272	53.7
	85	61	549	549	37.7	529	529	41.7	507	507	46.5	482	482	52.1
		67	592	477	38.5	565	466	42.5	534	453	47.1	503	441	52.5
		73	654	381	39.7	624	370	43.7	591	358	48.3	555	346	53.6

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 16: MPS 062 Standard Airflow Cooling Capacities

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)								
			85°			95°			105°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
18,000	75	63	664	489	47.1	635	476	52.7	603	463	59.2
		67	717	409	48.3	685	396	53.9	652	383	60.5
		71	773	327	49.6	740	314	55.3	704	302	61.9
	80	63	665	587	47.2	637	574	52.8	607	560	59.3
		67	717	507	48.3	686	494	54.0	651	481	60.5
		71	773	425	49.6	738	412	55.3	703	399	61.9
	85	63	677	677	47.4	654	654	53.1	629	629	59.8
		67	717	604	48.3	686	591	54.0	653	578	60.5
		71	772	523	49.7	738	510	55.3	702	497	61.9
21,000	75	63	681	529	47.5	651	516	53.1	619	503	59.6
		67	736	436	48.7	703	423	54.3	668	410	60.9
		71	793	341	50.1	758	329	55.8	721	316	62.4
	80	63	687	641	47.6	657	627	53.3	625	612	59.8
		67	735	549	48.8	702	536	54.4	667	523	61.0
		71	793	455	50.1	757	442	55.7	720	429	62.3
	85	63	715	715	48.2	688	688	54.0	661	661	60.7
		67	738	661	48.8	706	648	54.5	672	634	61.1
		71	791	568	50.1	756	555	55.8	719	542	62.4
23,700	75	63	695	564	48.2	664	551	53.4	630	537	59.9
		67	749	459	48.8	715	446	54.6	679	433	61.2
		71	807	353	50.1	771	341	56.1	732	328	62.7
	80	63	703	685	47.8	673	668	53.7	644	644	60.3
		67	748	586	49.0	715	573	54.7	679	559	61.3
		71	806	481	50.5	769	468	56.1	731	455	62.7
	85	63	742	742	48.9	715	715	54.6	686	686	61.4
		67	754	710	49.2	722	696	54.9	688	679	61.5
		71	805	608	50.5	769	595	56.1	731	581	62.7

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 17: MPS 062 High Airflow Cooling Capacities

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)								
			85°			95°			105°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
21,000	75	63	694	536	47.8	664	523	53.4	629	509	59.9
		67	748	442	49.0	715	429	54.6	680	415	61.2
		71	808	347	50.5	772	334	56.1	734	321	62.8
	80	63	698	649	47.9	668	635	53.5	637	621	60.1
		67	748	556	49.1	714	543	54.7	679	529	61.3
		71	806	461	50.5	771	448	56.2	732	435	62.8
	85	63	726	726	48.5	700	700	54.3	672	672	61.0
		67	752	671	49.2	720	657	54.8	685	643	61.4
		71	807	576	50.5	772	563	56.1	733	549	62.8
24,000	75	63	710	576	48.2	676	562	53.8	642	547	60.3
		67	763	468	49.4	729	455	55.0	692	442	61.6
		71	822	491	50.9	785	478	56.6	-	-	-
	80	63	718	701	48.4	686	683	54.0	657	657	60.7
		67	763	598	49.5	729	585	55.1	692	571	61.6
		71	822	491	50.9	785	478	56.6	-	-	-
	85	63	758	758	49.3	731	731	55.0	701	701	61.8
		67	770	726	49.6	736	711	55.3	702	694	61.9
		71	824	621	50.9	787	608	56.5	-	-	-
27,000	75	63	721	613	48.5	688	599	54.0	653	584	60.6
		67	776	495	49.8	740	481	55.4	702	467	61.9
		71	836	374	51.2	-	-	-	-	-	-
	80	63	737	737	48.8	709	709	54.5	680	680	61.2
		67	776	639	49.8	741	625	55.4	703	611	62.0
		71	837	520	51.3	-	-	-	-	-	-
	85	63	785	785	49.9	756	756	55.7	725	725	62.5
		67	788	776	50.1	755	755	55.8	723	723	62.6
		71	837	665	51.3	-	-	-	-	-	-

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 18: MPS 070 High Airflow Cooling Capacities

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)								
			85°			95°			105°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
22,000	75	63	784	586	57.6	743	568	64.7	697	548	73.1
		67	838	484	58.8	794	467	66.0	746	448	74.4
		71	896	381	60.1	849	364	67.5	796	465	75.9
	80	63	788	705	57.6	746	687	64.8	702	667	73.2
		67	838	604	58.8	794	586	66.1	747	568	74.5
		71	894	500	60.1	847	484	67.5	796	465	75.9
	85	63	804	804	57.9	770	770	65.4	732	732	74.0
		67	839	723	58.8	796	705	66.2	749	686	74.6
		71	894	621	60.2	847	603	67.6	796	585	75.9
26,000	75	63	803	637	58.0	761	619	65.2	714	599	73.6
		67	857	518	59.2	812	501	66.5	762	482	74.9
		71	915	399	60.6	867	382	68.0	814	364	76.4
	80	63	809	774	58.1	768	753	65.4	725	725	73.8
		67	858	659	59.3	813	641	66.6	763	622	75.0
		71	915	539	60.6	866	522	68.0	813	504	76.4
	85	63	845	845	58.9	808	808	66.4	767	767	75.0
		67	861	796	59.4	819	778	66.8	769	755	75.2
		71	913	679	60.7	865	662	68.1	812	643	76.4
30,000	75	63	819	687	58.3	774	668	65.6	726	648	73.9
		67	873	552	59.6	826	535	66.9	775	516	75.2
		71	930	415	61.0	880	399	68.4	-	-	-
	80	63	831	830	58.6	793	793	66.0	751	751	74.5
		67	874	712	59.7	827	694	67.0	776	674	75.3
		71	929	576	61.0	879	559	68.4	-	-	-
	85	63	877	877	59.7	838	838	67.2	795	795	75.8
		67	881	862	59.9	836	835	67.3	793	793	75.9
		71	928	735	61.1	879	718	68.5	-	-	-

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Table 19: MPS 075 High Airflow Cooling Capacities

CFM	Entering Air Temperature (°F)		Ambient Air Temperature (°F)								
			85°			95°			105°		
	DB	WB	THC	SHC	kW	THC	SHC	kW	THC	SHC	kW
22,000	75	63	851	615	65.0	809	597	72.8	765	577	81.7
		67	910	513	66.3	865	495	74.2	817	476	83.2
		71	970	409	67.9	922	391	75.8	872	372	84.8
	80	63	853	735	65.0	811	716	72.8	768	697	81.8
		67	909	632	66.3	864	614	74.2	817	596	83.2
		71	969	528	67.9	922	511	75.8	871	492	84.8
	85	63	861	850	65.2	822	822	73.2	787	787	82.3
		67	910	752	66.4	866	734	74.3	819	715	83.3
		71	968	648	67.9	921	630	75.8	871	612	84.9
26,000	75	63	873	667	65.5	831	649	73.3	785	629	82.2
		67	932	547	66.9	885	529	74.8	836	510	83.7
		71	994	426	68.5	944	409	76.4	891	390	85.4
	80	63	878	806	65.6	835	786	73.4	789	765	82.4
		67	930	687	66.9	885	670	74.8	836	650	83.7
		71	992	566	68.5	942	549	76.4	890	530	85.4
	85	63	903	903	66.2	866	866	74.2	826	826	83.4
		67	935	827	67.1	889	808	75.0	840	788	84.0
		71	991	707	68.6	942	689	76.5	890	671	85.5
30,000	75	63	891	717	65.9	847	699	73.7	799	679	82.6
		67	949	581	67.4	901	563	75.2	850	544	84.2
		71	1011	443	69.0	958	425	76.9	904	407	85.9
	80	63	899	871	66.1	855	847	74.0	813	813	83.0
		67	949	741	67.4	901	723	75.3	850	703	84.3
		71	1008	604	69.0	957	586	76.9	903	567	85.8
	85	63	940	940	67.1	900	900	75.2	858	858	84.4
		67	954	897	67.6	907	875	75.5	858	851	84.6
		71	1009	764	69.0	958	746	77.0	905	727	86.0

Note: THC = Total Heat Capacity (gross), SHC = Sensible Heat Capacity (gross), kW = Total compressor kW
Cooling capacities are for standard conditions at sea level.

Performance Data

MPS 015 and 017 Ton ARI Correction Multipliers

Table 20: MPS 015–017 Multipliers

Option	% Multiplier		
	Capacity	EER	IEER
Gas (high)	100	99	99
Gas (low)	100	99	99
HW (high)	100	99	99
HW (low)	100	99	99
Electric	100	99	99
Economizer	100	99	99
VFD	100	99	99

Electric Heating Capacity

Table 21: MPS 015–075 Electric Heating Capacities

Unit	Nom cfm	Stages	Low Heat				Medium Heat				High Heat			
			kW	MBh	Delta T*	Min. cfm	kW	MBh	Delta T*	Min. cfm	kW	MBh	Delta T*	Min. cfm
015	6000	4	18	61		950	36	123		1900	72	246		3800
017	6800	4	18	61		950	36	123		1900	72	246		3800
025	10,000	4	36	123	11.4	1900	54	184	17.0	2900	72	246	22.7	3800
030	12,000	4	54	184	14.2	2900	72	246	19.0	3800	90	307	23.7	4800
035	14,000	4	54	184	12.2	2900	72	246	16.3	3800	90	307	20.3	4800
040	16,000	4	72	246	14.2	3800	90	307	17.8	4800	108	369	21.3	5700
050	20,000	4	72	246	11.4	3800	90	307	14.2	4800	108	369	17.1	5700
062	24,000	4	100	342	13.1	14,000	160	546	21.0	14,000	200	684	26.3	14,000
070	26,000	4	100	342	12.1	14,000	160	546	19.6	14,000	200	684	24.2	14,000
075	28,000	4	100	342	11.3	14,000	160	546	18.0	14,000	200	684	22.5	14,000

Note: * Temperature rise is calculated at nominal cfm

Hot Water Heating Capacity

Table 22: MPS 015–050 Hot Water Heating Capacities

Unit	Nom cfm	Low Heat					High Heat				
		MBh	Delta T*	GPM	Min. cfm	Inlet dia.	MBh	Delta T*	GPM	Min. cfm	Inlet dia.
015	6000	145	22.4	25.9	1850	1.5	270	41.7	25.9	1850	1.5
017	6800	158	21.5	30.2	1850	1.5	302	41.1	32.0	1850	1.5
025	10,000	218	20.1	21.6	1850	1.5	433	39.9	45.0	1850	1.5
030	12,000	297	22.8	29.0	2900	1.5	553	42.5	52.2	2900	2.5
035	14,000	315	20.7	30.5	2900	1.5	614	40.4	60.8	2900	2.5
040	16,000	389	22.4	34.0	2900	1.5	758	43.7	69.5	2900	2.5
050	20,000	446	20.6	43.4	2900	1.5	878	40.5	87.0	2900	2.5

Note: * Temperature rise is calculated at nominal cfm. Water temperature drop = 20°

Gas Heating Capacity

Table 23: MPS 015–075 Gas Heating Capacities

Data	Unit Size								
	015–025	015–025	030–035	030–035	040–050	040–050	062, 070, 075		
	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat	Low Heat	Medium Heat	High Heat
Heating Input (MBh)	240	480	300	600	400	800	500	800	988
Heating Output (MBh)	192	384	240	480	320	640	400	640	790
Steady State Efficiency	80%	80%	80%	80%	80%	80%	80%	80%	80%
Number of Stages	2	4	2	4	2	4	Mod	Mod	Mod
Turndown[1]	4:1	8:1	4:1	8:1	4:1	8:1	3:1	3:1	3:1
Minimum Airflow	2960	5920	3700	7400	4900	9800	6000	9600	12,000
Maximum Temperature Rise	60°F	60/100°F[4]	60°F	60/85°F[4]	60°F	60/85°F[4]	61°F	61°F	61°F
Gas Main Pressure									
Natural Gas (in. wc)	7-14	7-14	7-14	7-14	7-14	7-14	7-13.5	7-13.5	7.5-13.5
Liquid Propane (in. wc)	12-14	12-14	12-14	12-14	12-14	12-14	7-13.5	7-13.5	7.5-13.5
Connection Pipe sz/qty	3/4"/1	3/4"/2	3/4"/1	3/4"/2	3/4"/1	3/4"/2	1"/1	1-1/4"/1	1-1/4"/1
Manifold Pressure Natural Gas (per gas valve)									
Stage 1 (in. wc)	1.2	1.2	1.2	1.2	1.2	1.2	N/A	N/A	N/A
Stage 2 (in. wc)	3.2	3.2	3.2	3.2	3.2	3.2	N/A	N/A	N/A
Modulating Low fire[2]	0.4	0.4	0.4	0.4	0.4	0.4	N/A	N/A	N/A
Propane[3]									
Stage 1 (in. wc)	2.3	2.3	2.3	2.3	2.3	2.3	N/A	N/A	N/A
Stage 2 (in. wc)	10.0	10.0	10.0	10.0	10.0	10.0	N/A	N/A	N/A

Note: [1] Modulating gas heat only.
[2] Modulating gas heat not available with propane.
[3] See Table 7, page 28 and Table 8, page 29 for connection sizes.
[4] Stainless steelheat exchanger only in 100% OA configuration only.

Pressure Drops

Table 24: Component Pressure Drops—MPS 015–050

Component	Unit	Unit Airflow (CFM)								
		4000	6000	8000	10,000	12,000	14,000	16,000	18,000	20,000
Economizer/RA/OA	015–017	0.01	0.02	0.03	-	-	-	-	-	-
	025	0.01	0.02	0.03	0.05	-	-	-	-	-
	030–035	-	0.01	0.02	0.04	0.06	0.08	-	-	-
	040–050	-	-	0.01	0.02	0.03	0.04	0.05	0.06	0.08
Filter	015–017	0.04	0.09	0.16	-	-	-	-	-	-
	025	0.04	0.09	0.16	0.25	-	-	-	-	-
	030–035	0.02	0.04	0.07	0.11	0.16	0.21	-	-	-
	040	-	0.02	0.05	0.08	0.12	0.16	0.21	-	-
	050	-	-	0.04	0.06	0.08	0.11	0.15	0.19	0.23
Cooling Coil	015–017	0.08	0.17	0.31	-	-	-	-	-	-
	025	0.08	0.17	0.31	0.47	-	-	-	-	-
	030–035	-	0.09	0.15	0.24	0.34	0.47	-	-	-
	040	-	-	0.14	0.22	0.32	0.45	0.58	-	-
	050	-	-	0.10	0.15	0.21	0.29	0.38	0.48	0.59
Hot Gas Reheat	015–025	0.06	0.11	0.17	0.23	-	-	-	-	-
	030–035	-	0.07	0.10	0.14	0.19	0.23	-	-	-
	040–050	-	-	0.07	0.09	0.12	0.15	0.18	0.22	0.25

Table 25: Gas Heat Pressure Drops—MPS 015–050

Unit	Heat Type	Unit Airflow (CFM)								
		4000	6000	8000	10,000	12,000	14,000	16,000	18,000	20,000
015–017	Low (240MBH)	0.08	0.19	0.33	-	-	-	-	-	-
	High (480 MBH)	0.14	0.31	0.55	-	-	-	-	-	-
025	Low (240MBH)	-	0.19	0.33	0.52	0.74	-	-	-	-
	High (480 MBH)	-	0.31	0.55	0.86	1.24	-	-	-	-
030–035	Low (300MBH)	-	-	0.10	0.16	0.23	0.31	-	-	-
	High (600 MBH)	-	-	0.18	0.28	0.41	0.56	-	-	-
040–050	Low (400 MBH)	-	-	0.04	0.07	0.10	0.14	0.18	0.23	0.28
	High (800 MBH)	-	-	0.11	0.18	0.26	0.35	0.46	0.58	0.71

Table 26: High Temperature Furnace Airside Pressure Drops

Unit	4000	6000	8000	10,000	12,000	14,000
015 - 017	0.14	0.31	-	-	-	-
025	0.14	0.31	0.55	-	-	-
030 - 035	0.13	0.29	0.53	0.83	-	-
040 - 050	-	0.26	0.45	0.69	0.98	1.32

Table 27: Hot Water Pressure Drops—MPS 015–050

Unit	Heat Type	Unit Airflow (CFM)								
		4000	6000	8000	10,000	12,000	14,000	16,000	18,000	20,000
015–017	015–017 Low (1 row)	0.09	0.17	0.27	-	-	-	-	-	-
	015–017 High (2 row)	0.17	0.34	0.68	-	-	-	-	-	-
025	020–025 Low (1 row)	-	0.20	0.32	0.52	-	-	-	-	-
	020–025 High (2 row)	-	0.28	0.46	0.98	-	-	-	-	-
030–035	030–035 Low (1 row)	-	-	0.14	0.20	0.27	0.35	-	-	-
	030–035 High (2 row)	-	-	0.23	0.33	0.46	0.59	-	-	-
040–050	040–050 Low (1 row)	-	-	-	0.19	0.26	0.34	0.42	0.51	0.61
	040–050 High (2 row)	-	-	-	0.40	0.54	0.69	0.86	1.05	1.25

Table 28: Electric Heat Pressure Drops—MPS 015–050

Unit	Unit Airflow (CFM)								
	4000	6000	8000	10,000	12,000	14,000	16,000	18,000	20,000
015–017	0.05	0.11	0.20	-	-	-	-	-	-
025	0.05	0.11	0.20	0.31	-	-	-	-	-
030–035	-	0.05	0.10	0.15	0.22	0.30	0.39	-	-
040–050	-	-	0.05	0.08	0.11	0.15	0.19	0.24	0.30

Table 29: Component Pressure Drops—MPS 062–075

Component		Airflow (cfm)								
		14,000	16,000	18,000	20,000	22,000	24,000	26,000	28,000	30,000
Outdoor/return air options[1]	0–30% outside air hood w/damper	0.06	0.08	0.10	0.12	0.15	0.18	0.21	0.24	0.28
	100% outside air hood w/damper	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06
	0–100% economizer, w/o RAF	0.08	0.10	0.13	0.16	0.19	0.23	0.27	0.31	0.36
Filter options	30% pleated	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.25	0.27
	Prefilter, standard flow	0.17	0.20	0.24	0.28	0.32	0.37	0.41	-	-
	Prefilter, medium flow	0.13	0.15	0.18	0.21	0.25	0.28	0.32	0.35	0.39
	65% cartridge, standard flow	0.27	0.34	0.41	0.49	0.57	0.66	0.76	-	-
	65% cartridge, medium flow	0.20	0.25	0.31	0.36	0.43	0.49	0.56	0.63	0.71
	95% cartridge, standard flow	0.38	0.46	0.55	0.64	0.74	0.84	0.95	-	-
	95% cartridge, medium flow	0.29	0.35	0.42	0.49	0.56	0.64	0.72	0.81	0.89
Cooling options[2]	DX, standard airflow, 5-row, 10 fpi	0.41	0.50	0.59	0.69	0.79	0.89	-	-	-
	DX, high airflow, 5-row, 10 fpi	-	0.38	0.45	0.52	0.60	0.68	0.79	0.88	0.98
Heating options	Hot water, 1-row	0.12	0.15	0.19	0.22	0.26	0.30	0.35	0.39	0.44
	Hot water, 2-row	0.24	0.30	0.37	0.44	0.52	0.61	0.69	0.78	0.88
	Electric heat	0.07	0.10	0.12	0.15	0.18	0.22	0.25	0.29	0.34
Furnace	Low heat	0.10	0.13	0.17	0.21	0.25	0.30	0.35	0.41	0.47
	Medium heat	0.21	0.12	0.16	0.20	0.24	0.28	0.33	0.38	0.44
	High heat	0.10	0.12	0.16	0.20	0.24	0.28	0.33	0.38	0.44

Note: [1]Pressure drop is based on 30% of listed airflow.
[2]DX coil pressure drops are based on wet coils. Standard air flow coil not applicable on sizes 070E-075E.

Table 30: Pressure Drop—Standard Airflow Energy Wheel

Cabinet	Wheel Diameter	1,000	2,000	3,000	4,000	5,000	6,000	7,000
15 - 25	46	0.30	0.60	0.89	—	—	—	—
30 - 35	52	0.18	0.33	0.48	0.62	0.76	—	—
40 - 50	64	0.15	0.30	0.45	0.60	0.75	0.90	1.32

Table 31: Pressure Drop—High Airflow Energy Wheel

Cabinet	Wheel Diameter	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000
15 - 25	52	0.33	0.48	0.62	0.76	—	—	—	—	—	—
30 - 35	64	0.30	0.45	0.60	0.75	0.90	1.05	1.20	—	—	—
40 - 50	74	0.18	0.27	0.34	0.42	0.50	0.57	0.65	0.72	0.79	0.87

Table 32: Pressure Drop—Standard Airflow Energy Wheel Filter

Cabinet	1,000	2,000	3,000	4,000	5,000	6,000	7,000
15 - 25	0.01	0.01	0.02	0.03	—	—	—
30 - 35	0.01	0.03	0.08	0.14	0.22	—	—
40 - 50	0.01	0.02	0.03	0.06	0.10	0.14	0.19

Table 33: Pressure Drop—High Airflow Energy Wheel Filter

Cabinet	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000
15 - 25	0.03	0.08	0.14	0.22	0.31	0.42	0.55	0.70	0.87	1.05
30 - 35	0.02	0.04	0.08	0.12	0.18	0.24	0.31	0.40	0.49	0.59
40 - 50	0.01	0.02	0.03	0.05	0.08	0.11	0.14	0.18	0.22	0.26

Table 34: Pressure Drop—Energy Wheel Back Draft Damper

Cabinet	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000
15 - 25	0.01	0.03	0.04	0.07	0.09	0.12	0.16	0.20	0.24	0.29
30 - 35	0.01	0.03	0.04	0.07	0.09	0.12	0.16	0.20	0.24	0.29
40 - 50	0.01	0.01	0.02	0.04	0.05	0.07	0.09	0.11	0.14	0.17

Hot Water Low/High Heat Curves

Figure 14: MPS 015–017 Low Heat

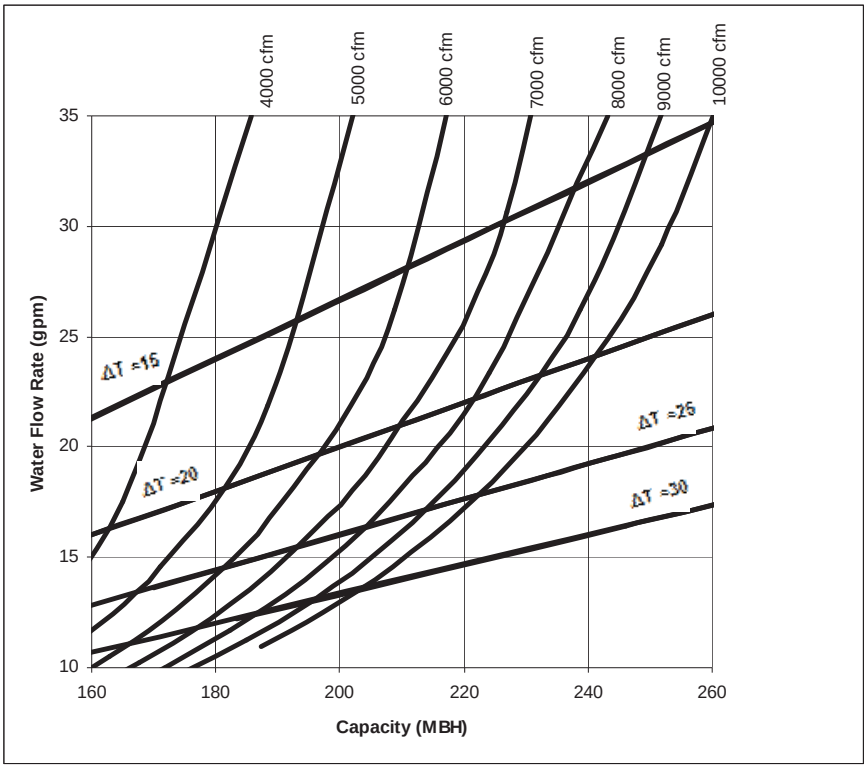


Figure 15: MPS 015–017 High Heat

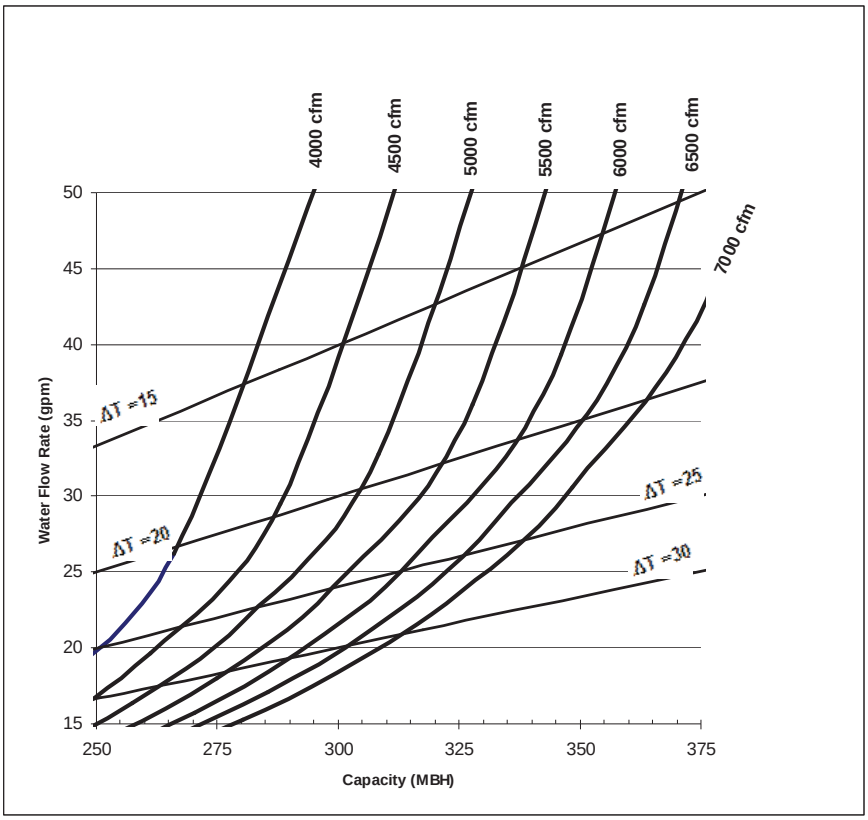


Figure 16: MPS 025 Low Heat

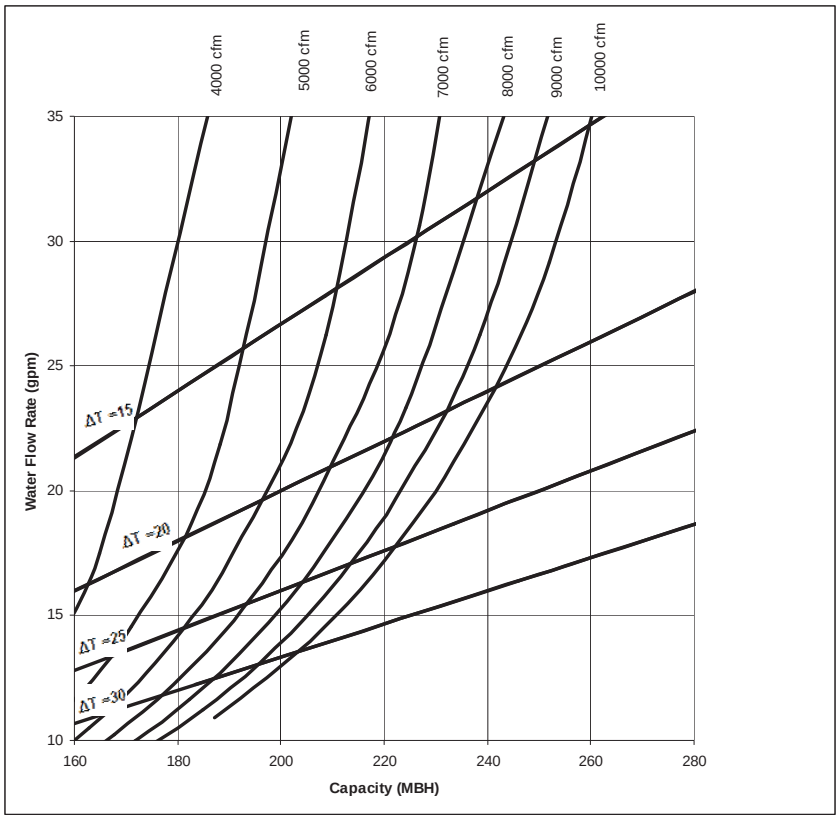


Figure 17: MPS 025 High Heat

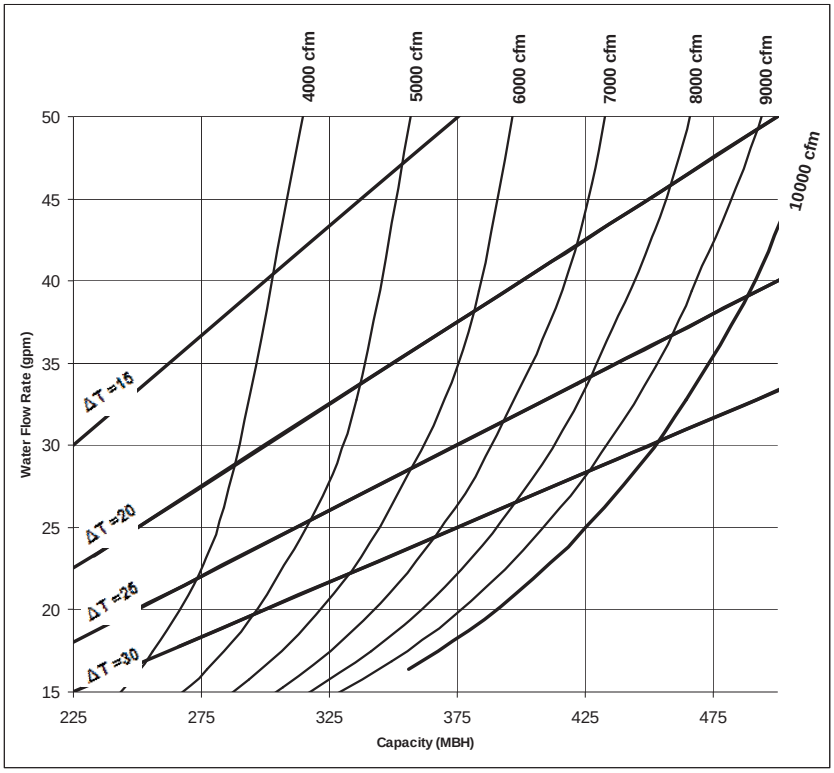


Figure 18: MPS 030–035 Low Heat

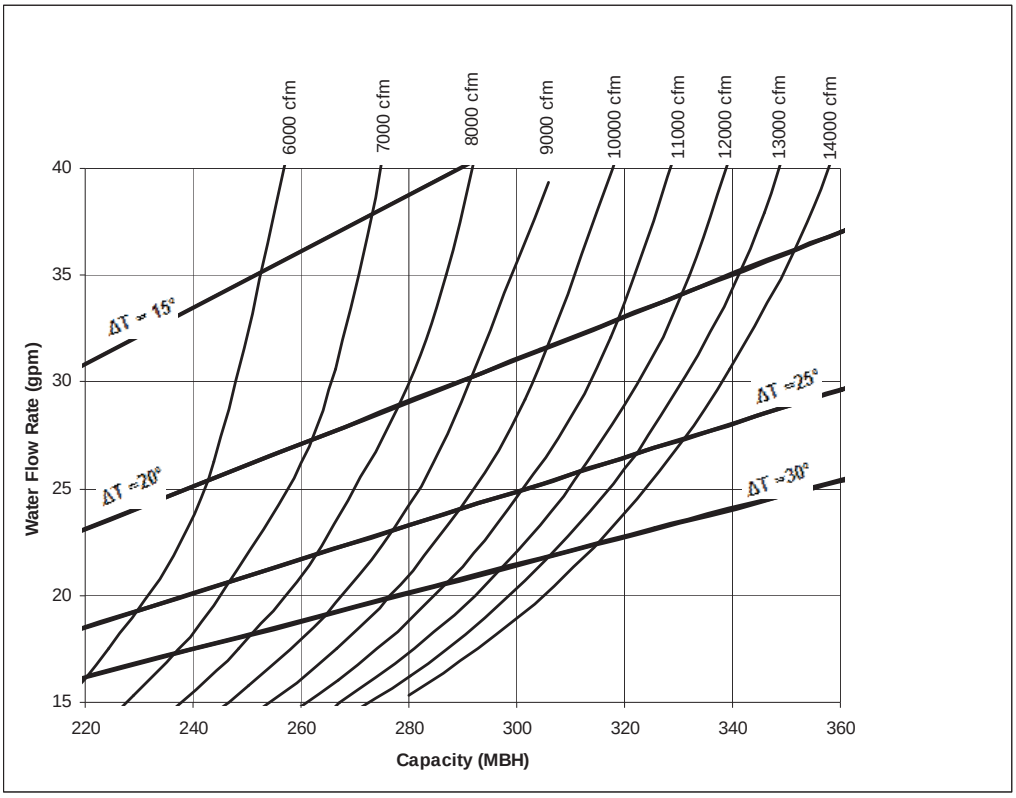


Figure 19: MPS 030–035 High Heat

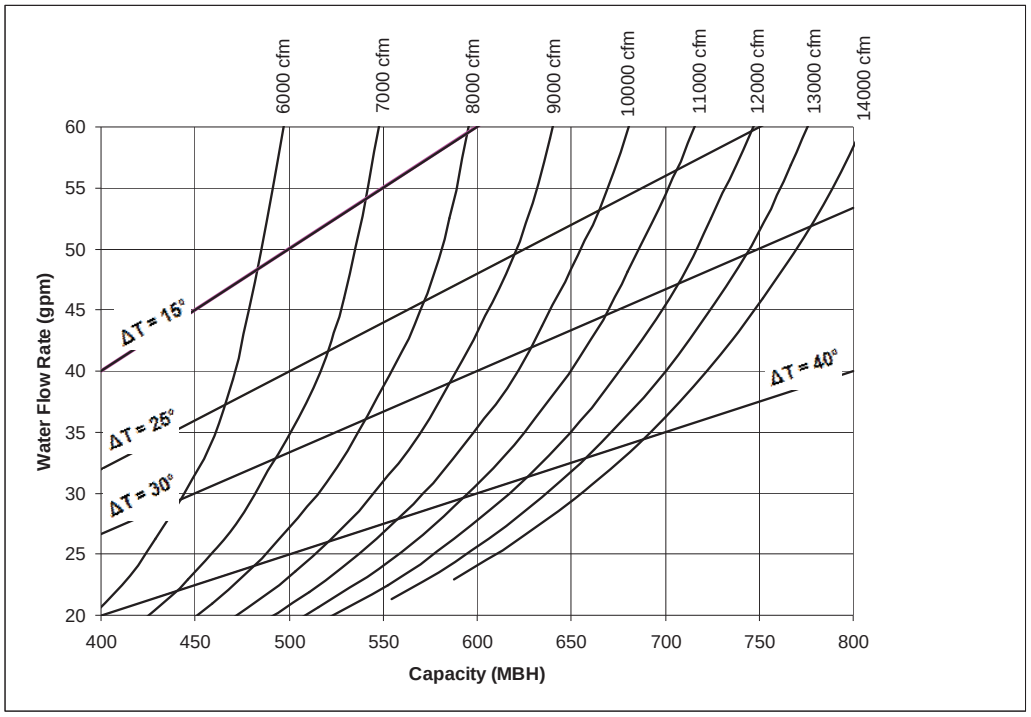


Figure 20: MPS 040–050 Low Heat

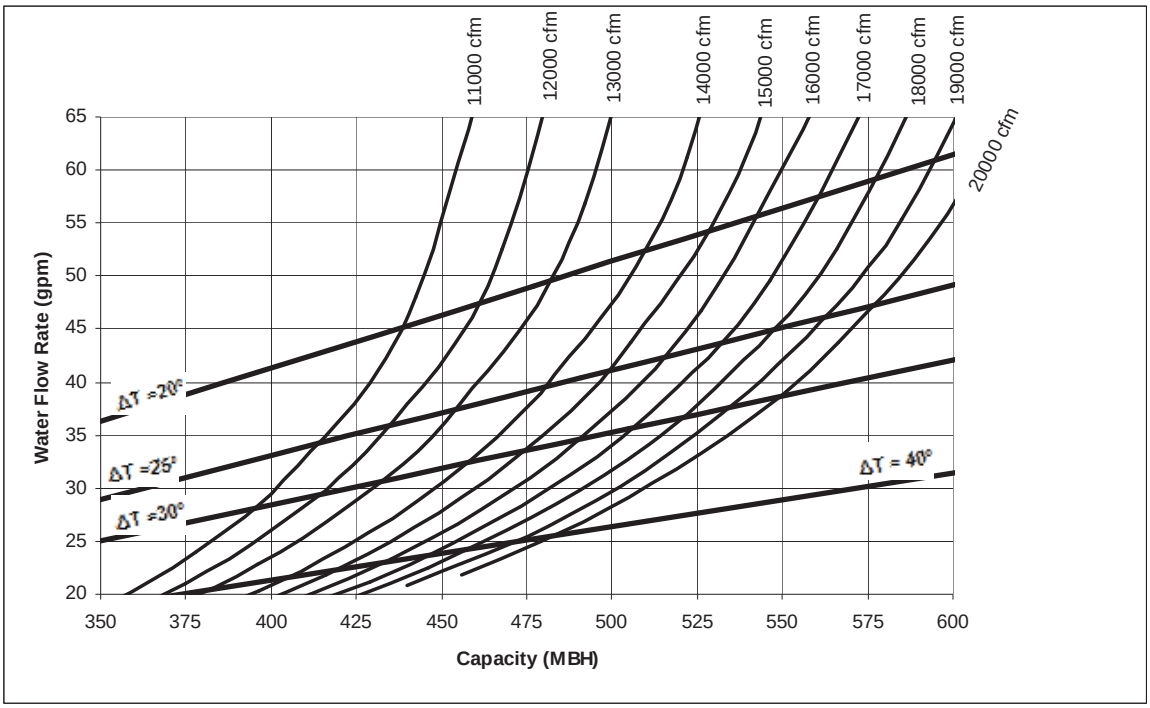


Figure 21: MPS 040–050 High Heat

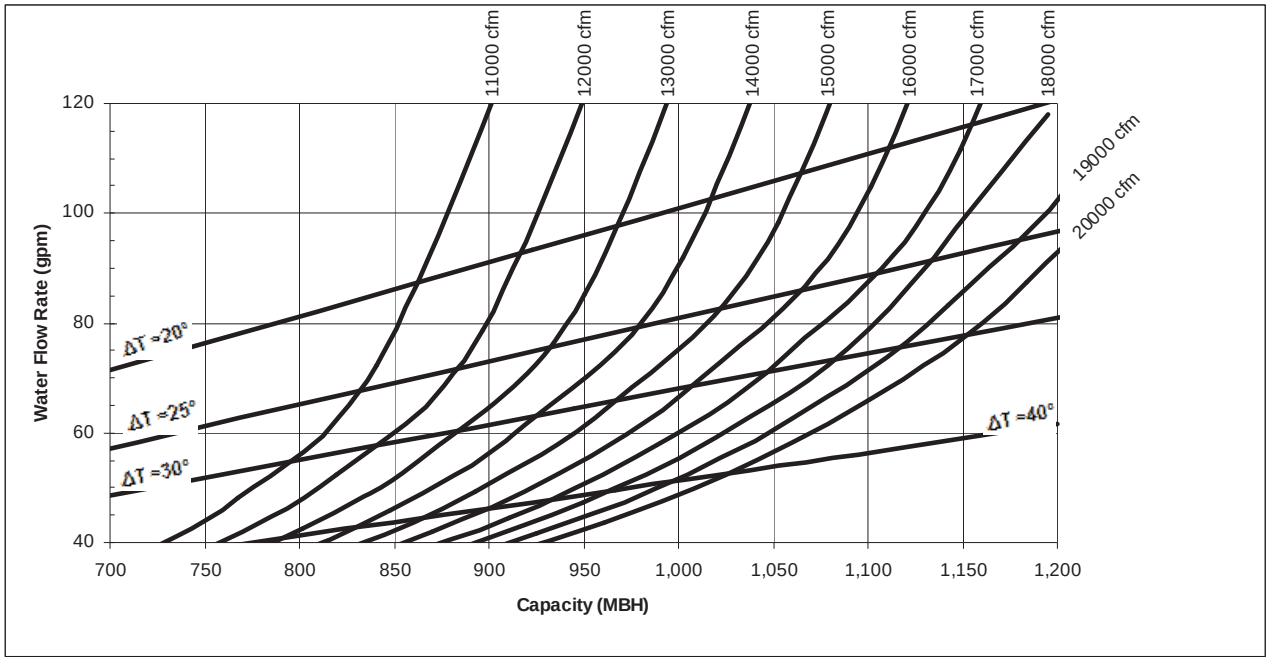


Figure 22: MPS 062–075 Standard Heat

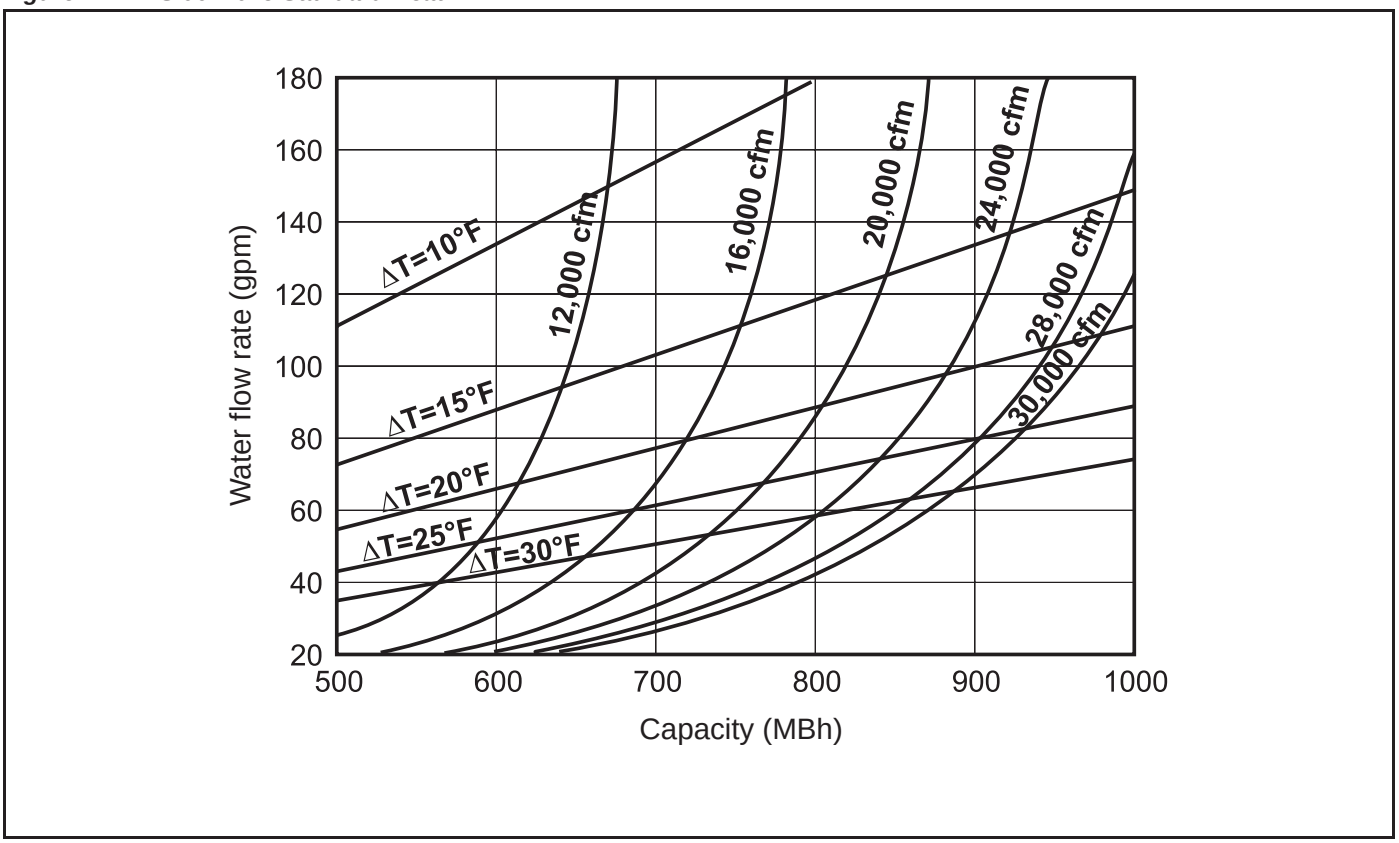
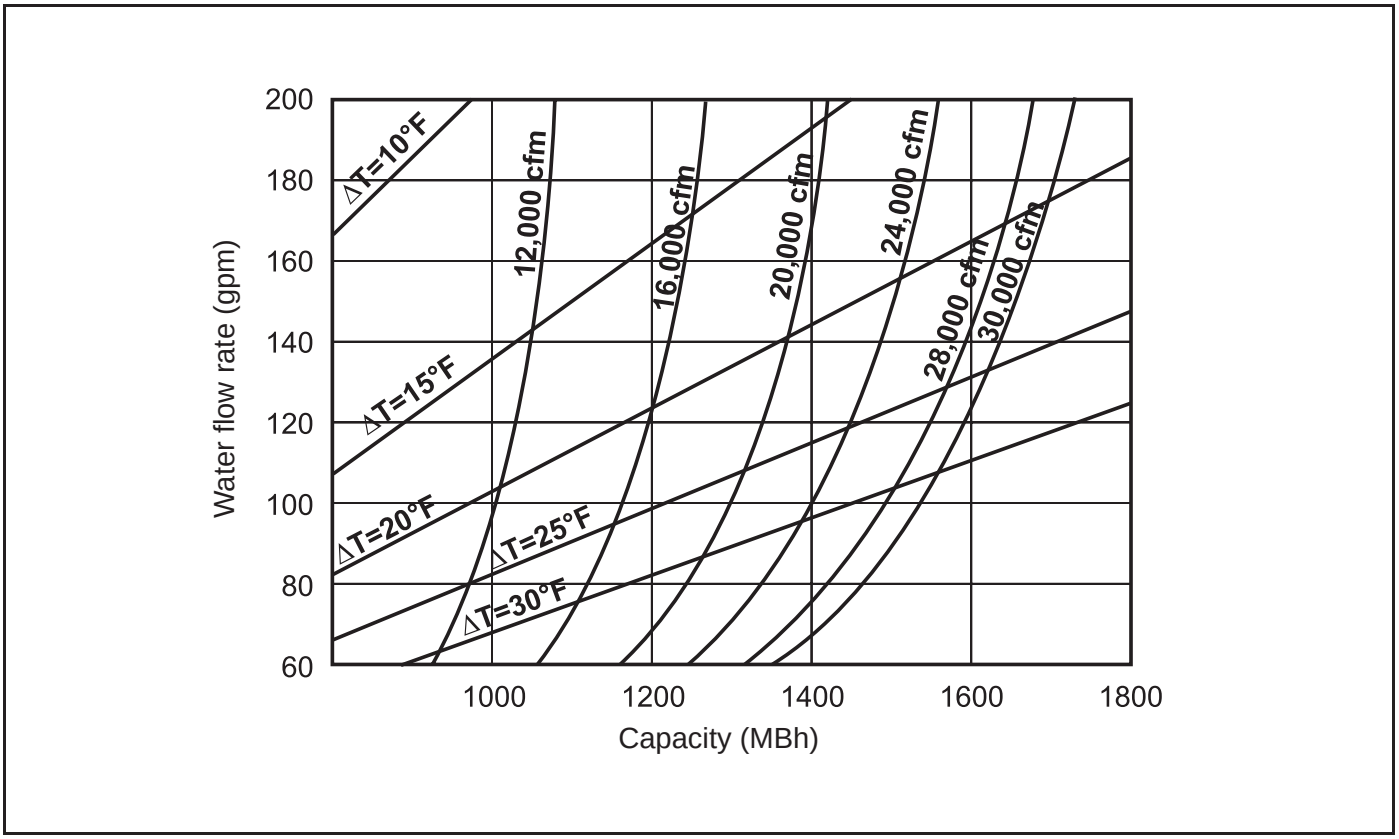


Figure 23: MPS 062–075 High Heat



Hot Water Pressure Drop Curves

Figure 24: MPS 015–017 Pressure Drop

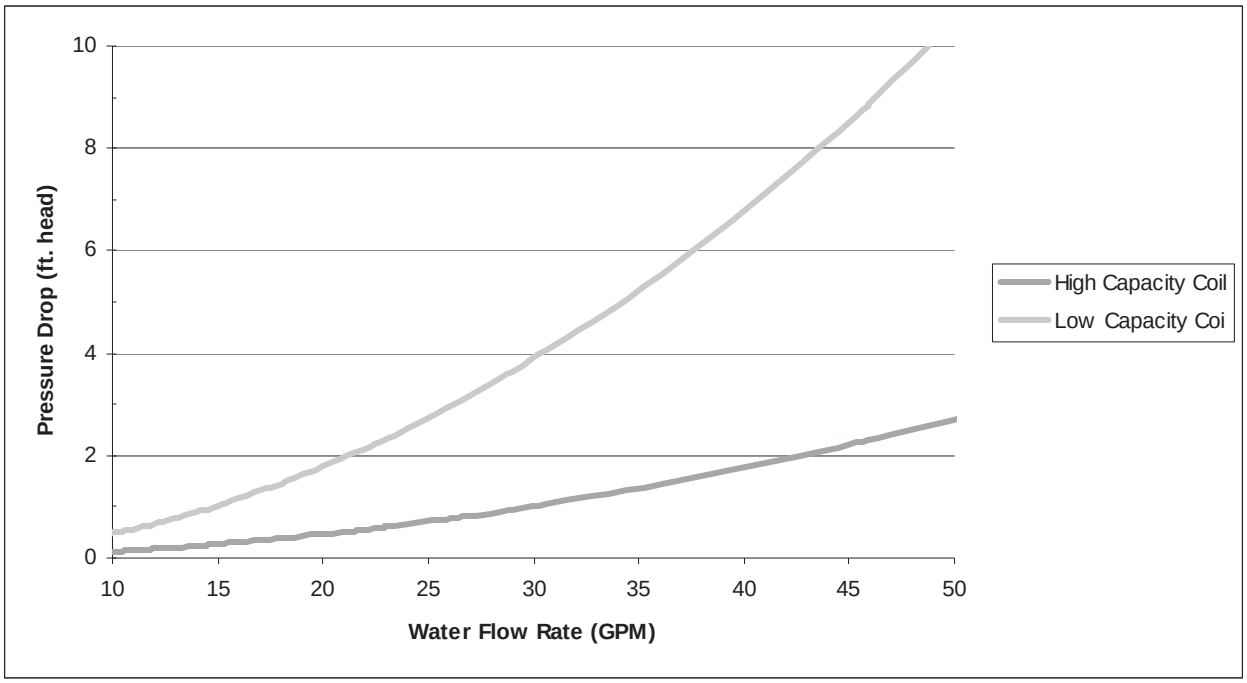


Figure 25: MPS 025 Pressure Drop

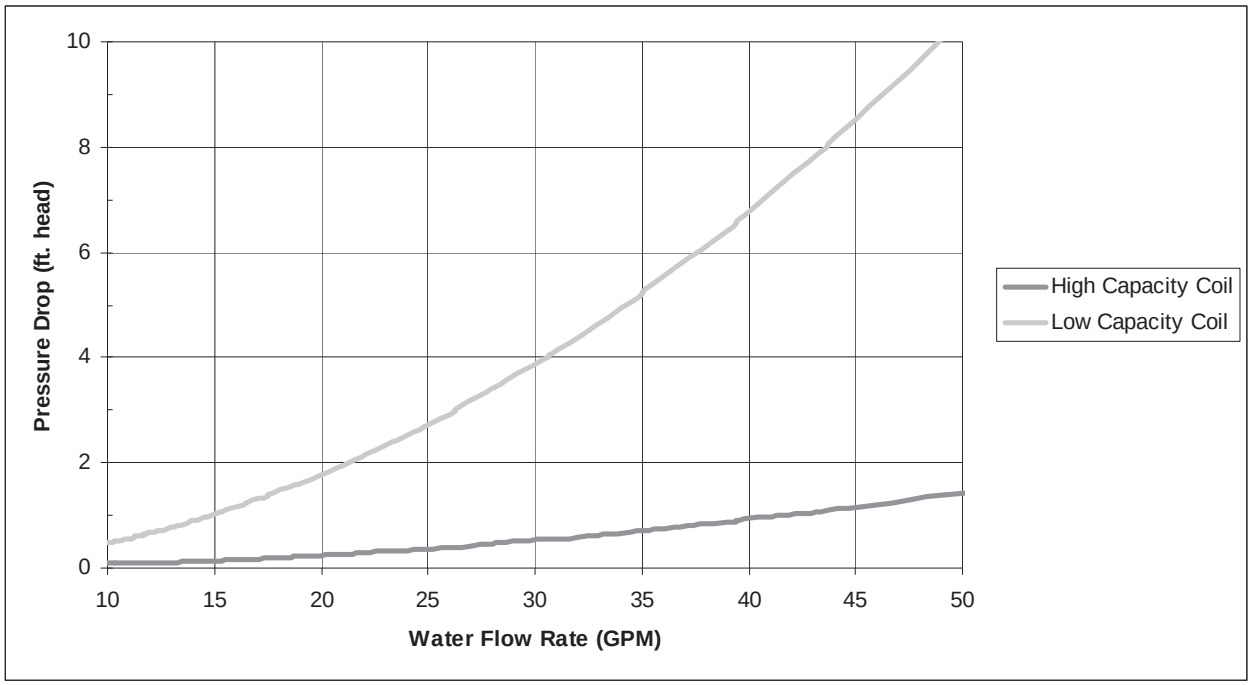


Figure 26: MPS 030–035 Pressure Drop

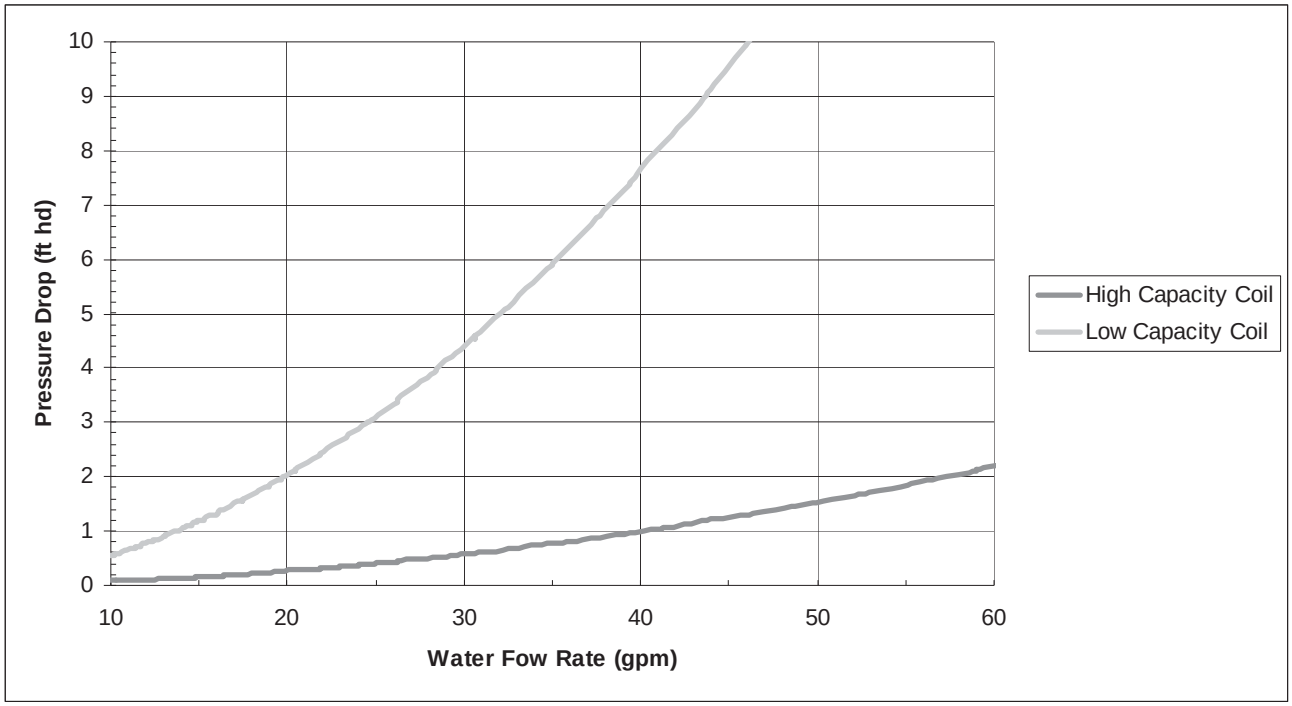


Figure 27: MPS 040–050 Pressure Drop

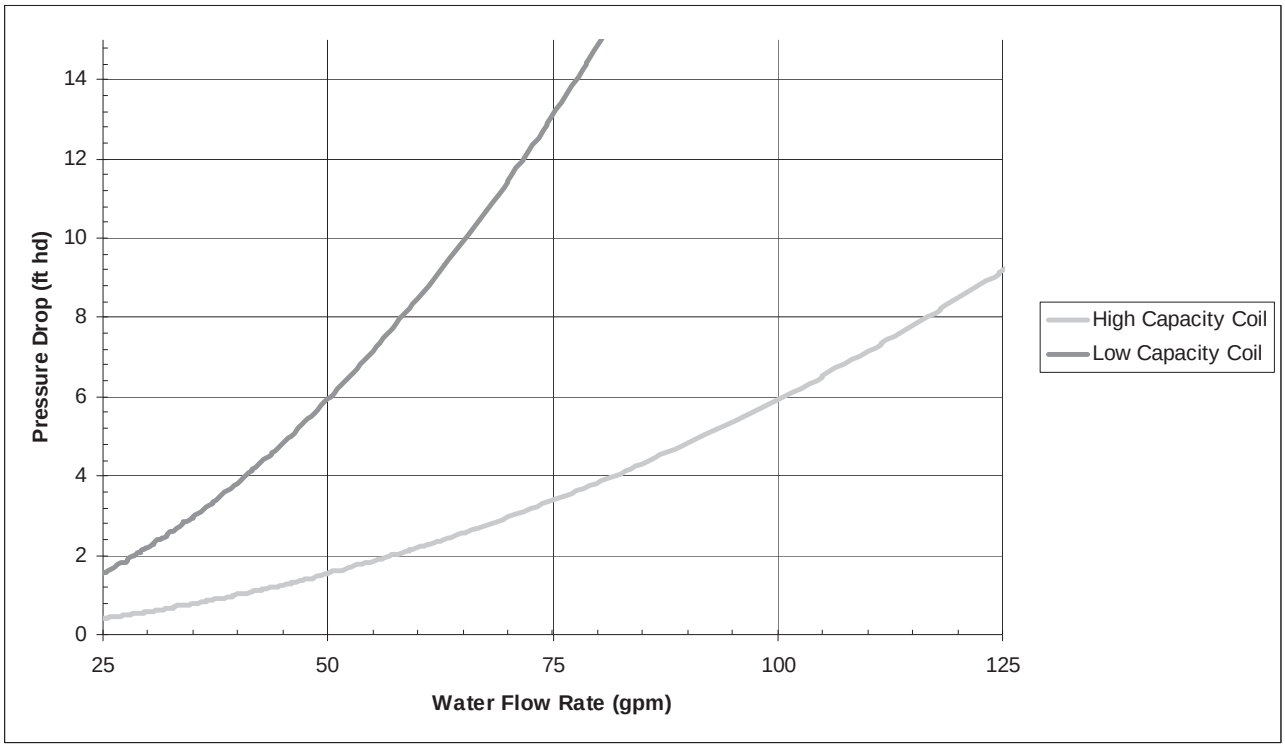
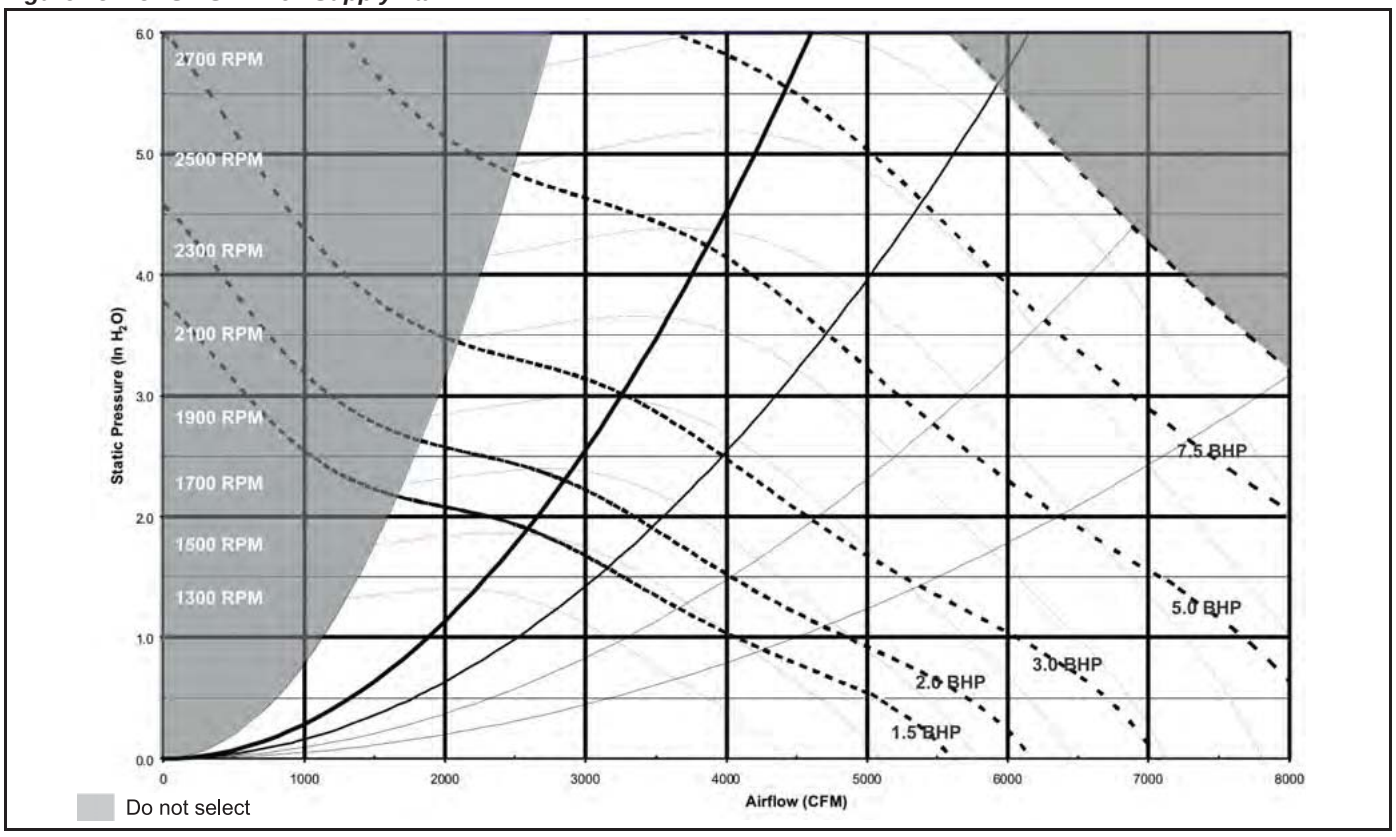


Table 35: Supply Fan Matrix

Cabinet	Standard	100% OA	100% with Energy Recovery	Energy Recovery with Economizer
15 ton	18"	15"	15"	18"
17 ton	20"	15"	15"	20"
25 ton	22"	18"	18"	22"
30 ton	24"	22"	22"	24"
35 ton	24"	22"	22"	24"
40 ton	30"	24"	30"	30"
50 ton	30"	24"	30"	30"

Figure 28: 18" SWSI Airfoil Supply Fan



Supply Fan Performance

Figure 29: 20" SWSI Airfoil Supply Fan

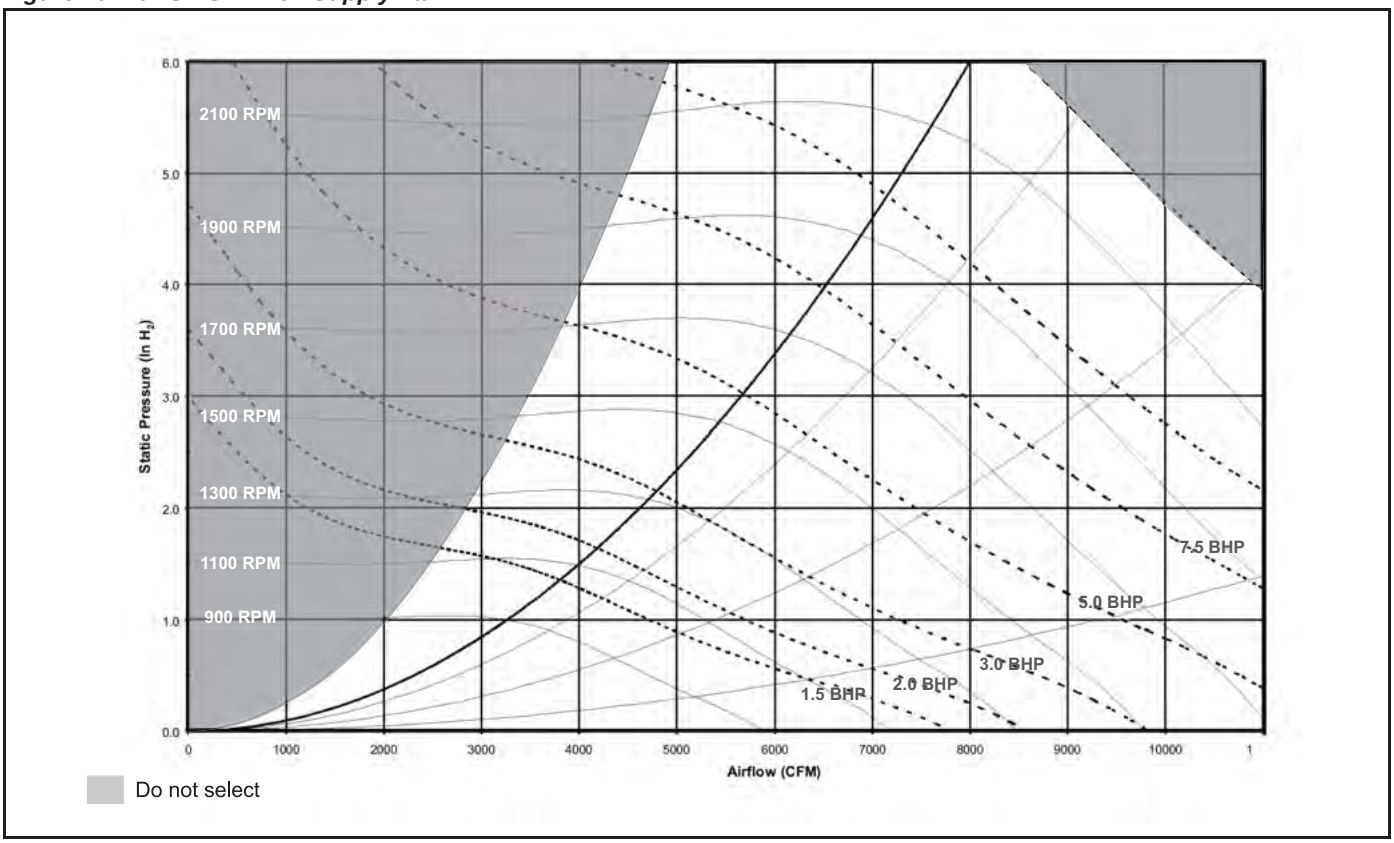


Figure 30: 22" SWSI Airfoil Supply Fan

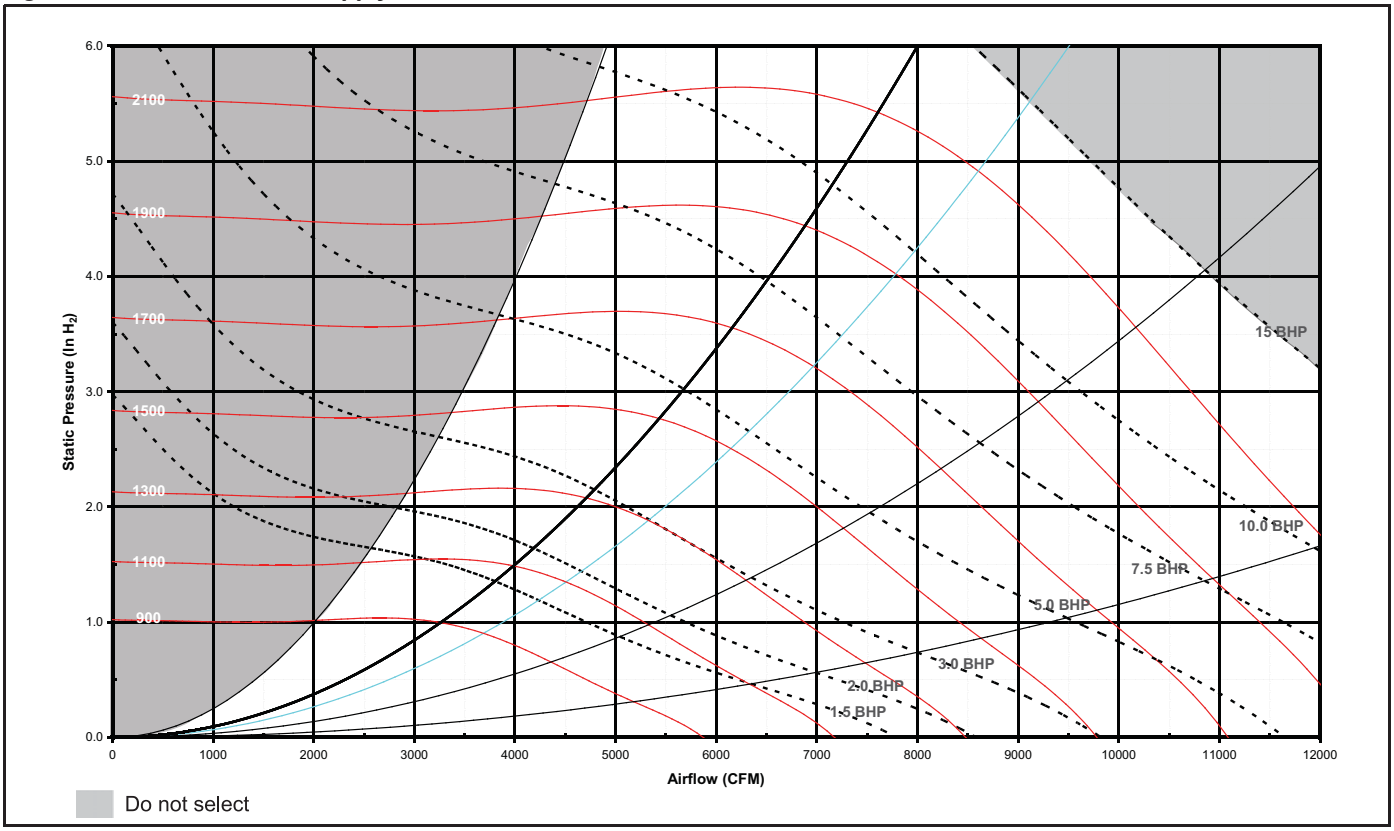


Figure 31: 24" SWSI Airfoil Supply Fan

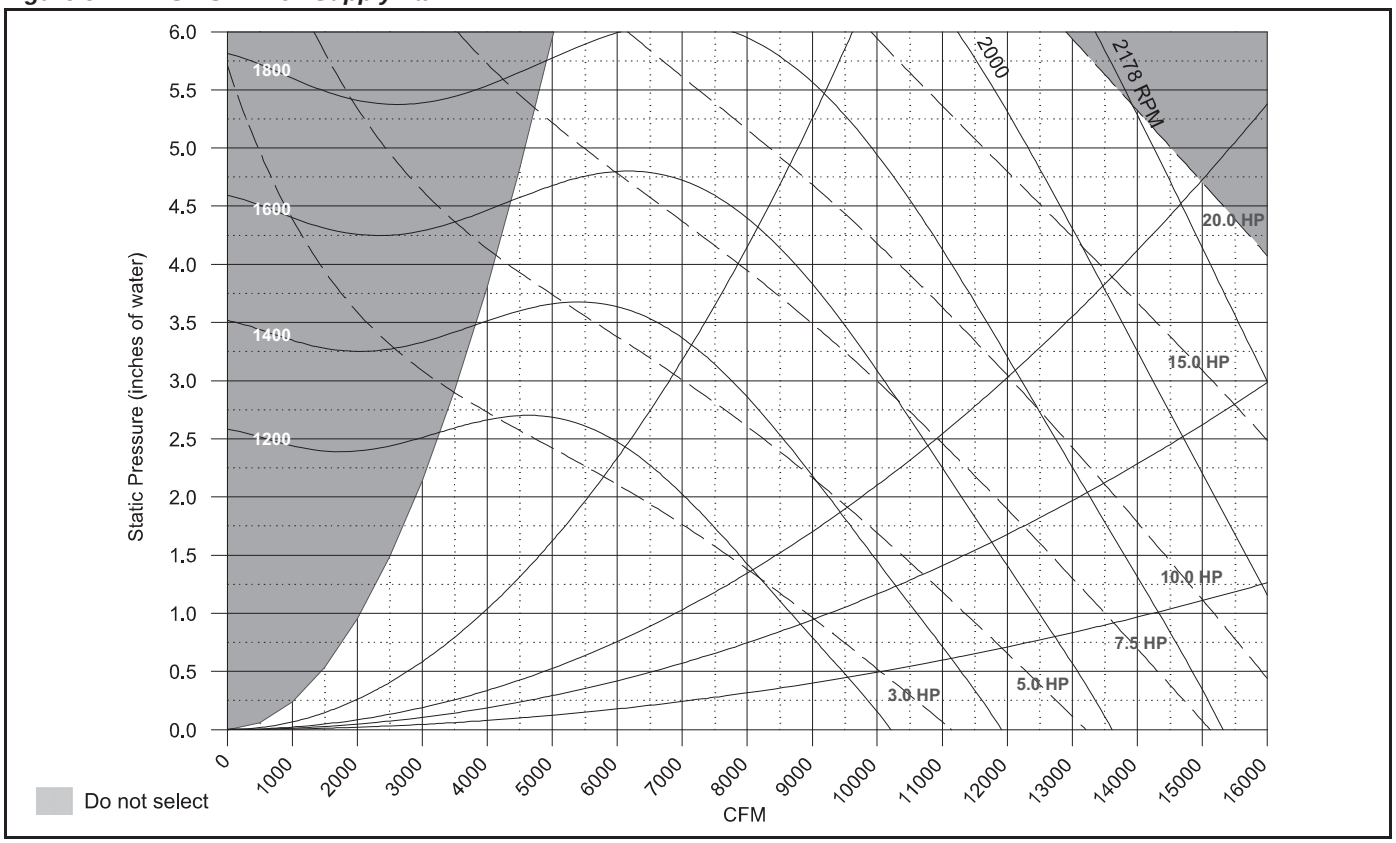
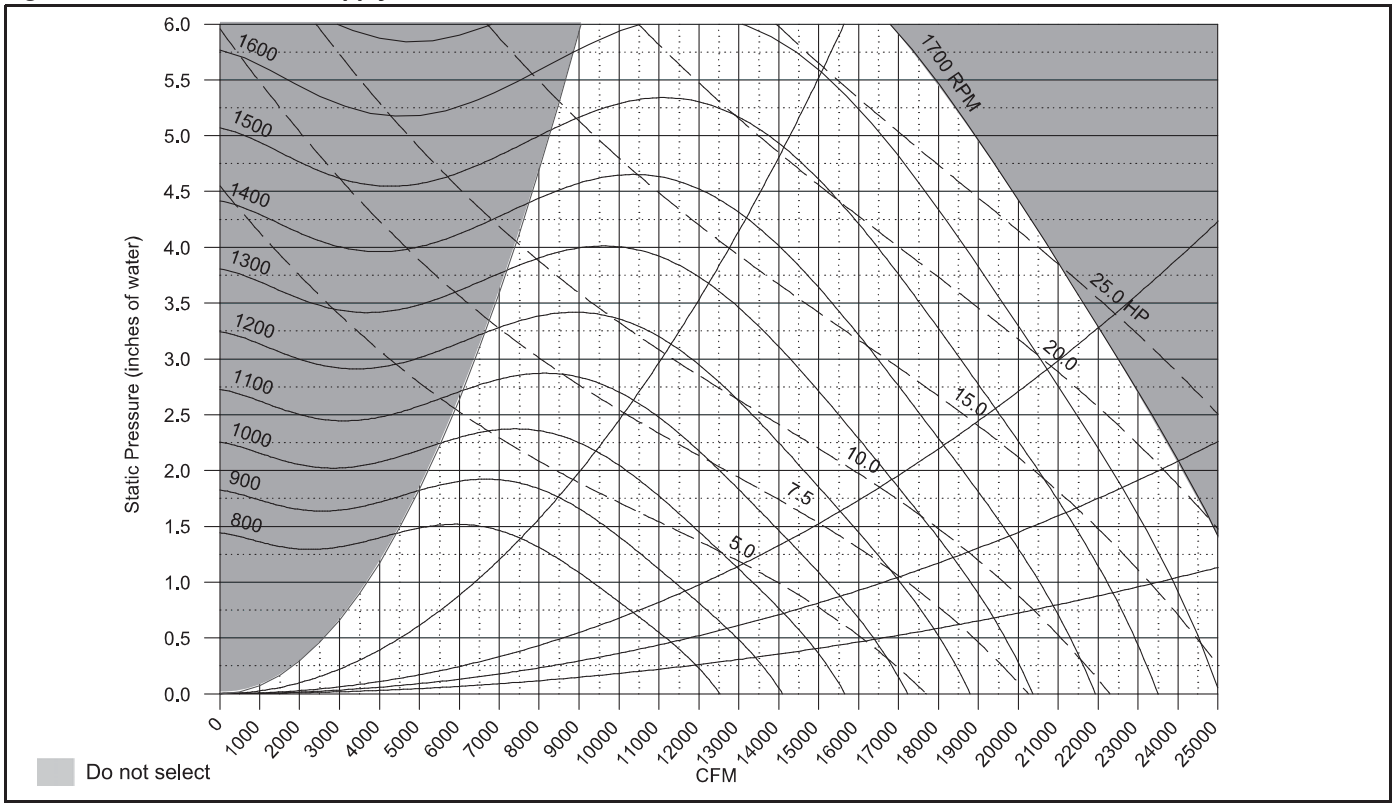
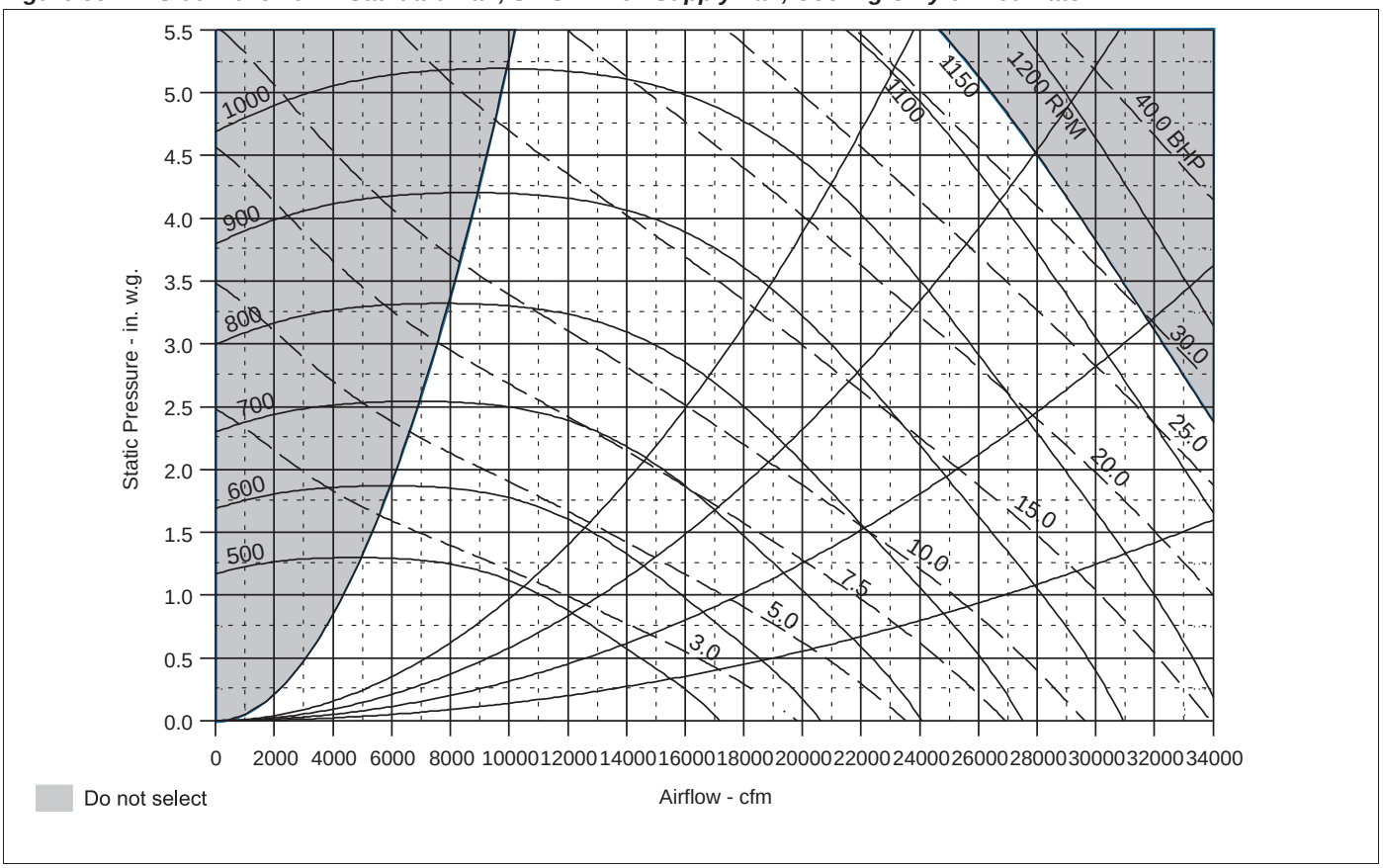


Figure 32: 30" SWSI Airfoil Supply Fan



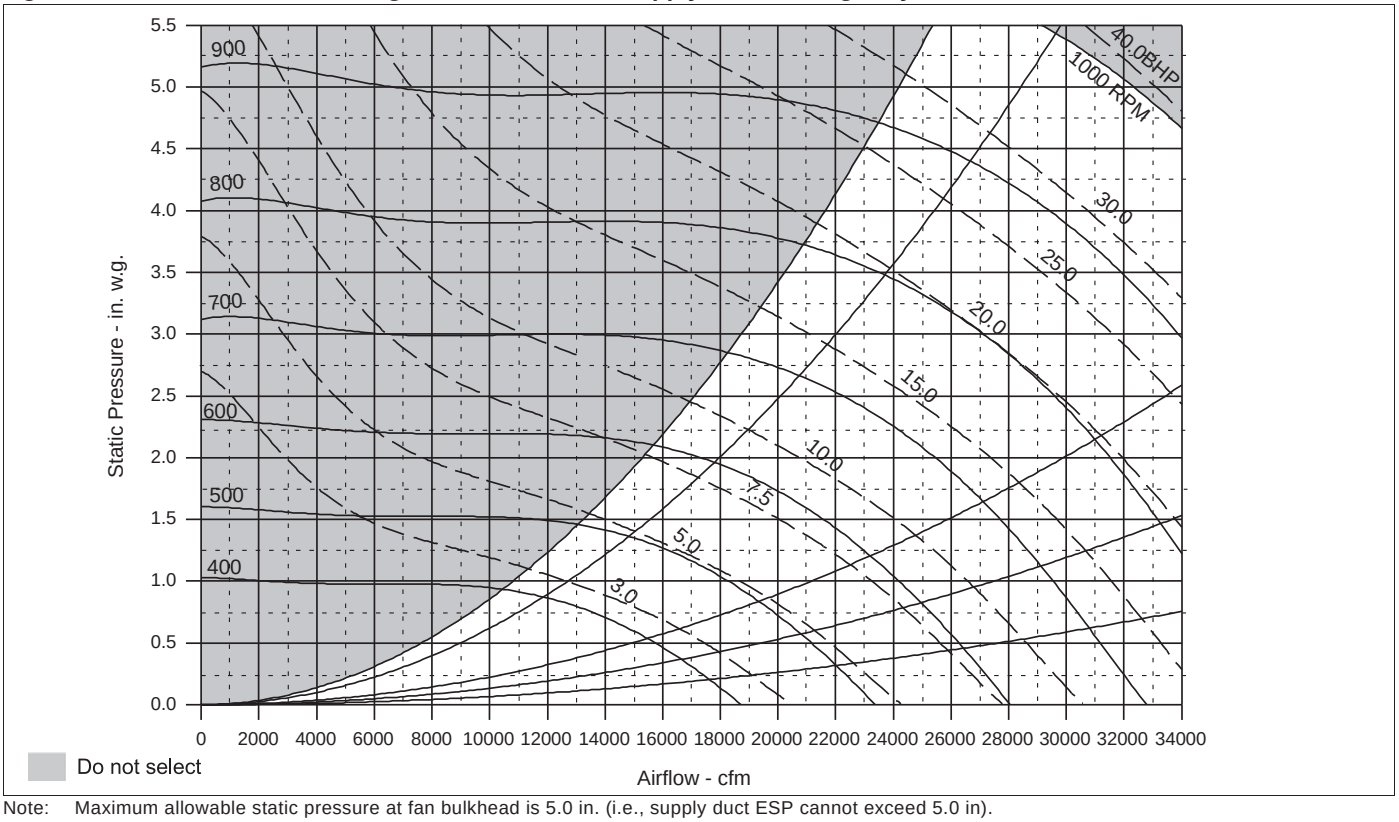
Supply Fan Performance

Figure 33: MPS 062–075 40-in. Standard Fan, SWSI Airfoil Supply Fan, Cooling Only or Hot Water



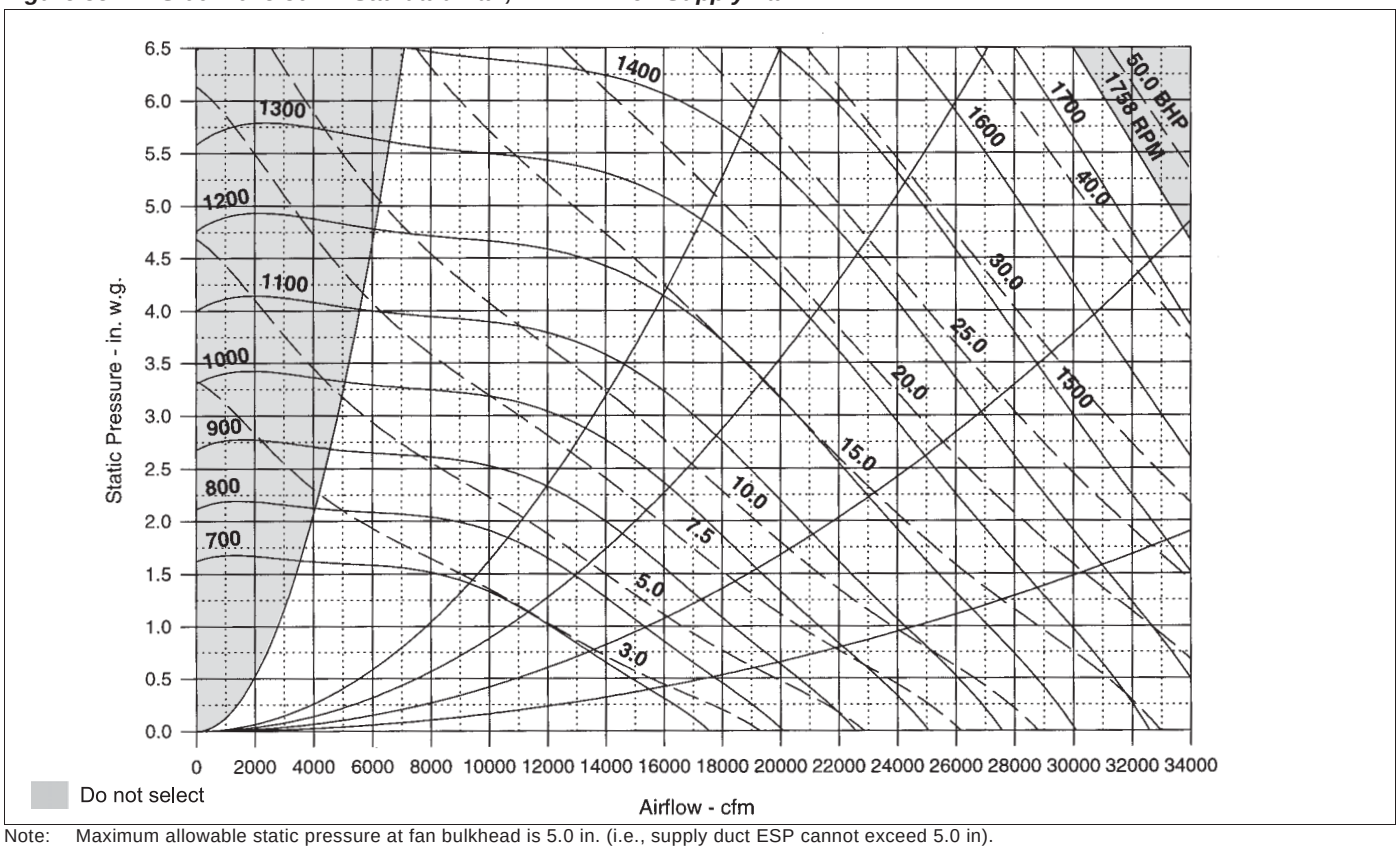
Note: Maximum allowable static pressure at fan bulkhead is 5.0 in. (i.e., supply duct ESP cannot exceed 5.0 in).

Figure 34: MPS 062–075 44-in. Large Fan, SWSI Airfoil Supply Fan, Cooling Only or Hot Water



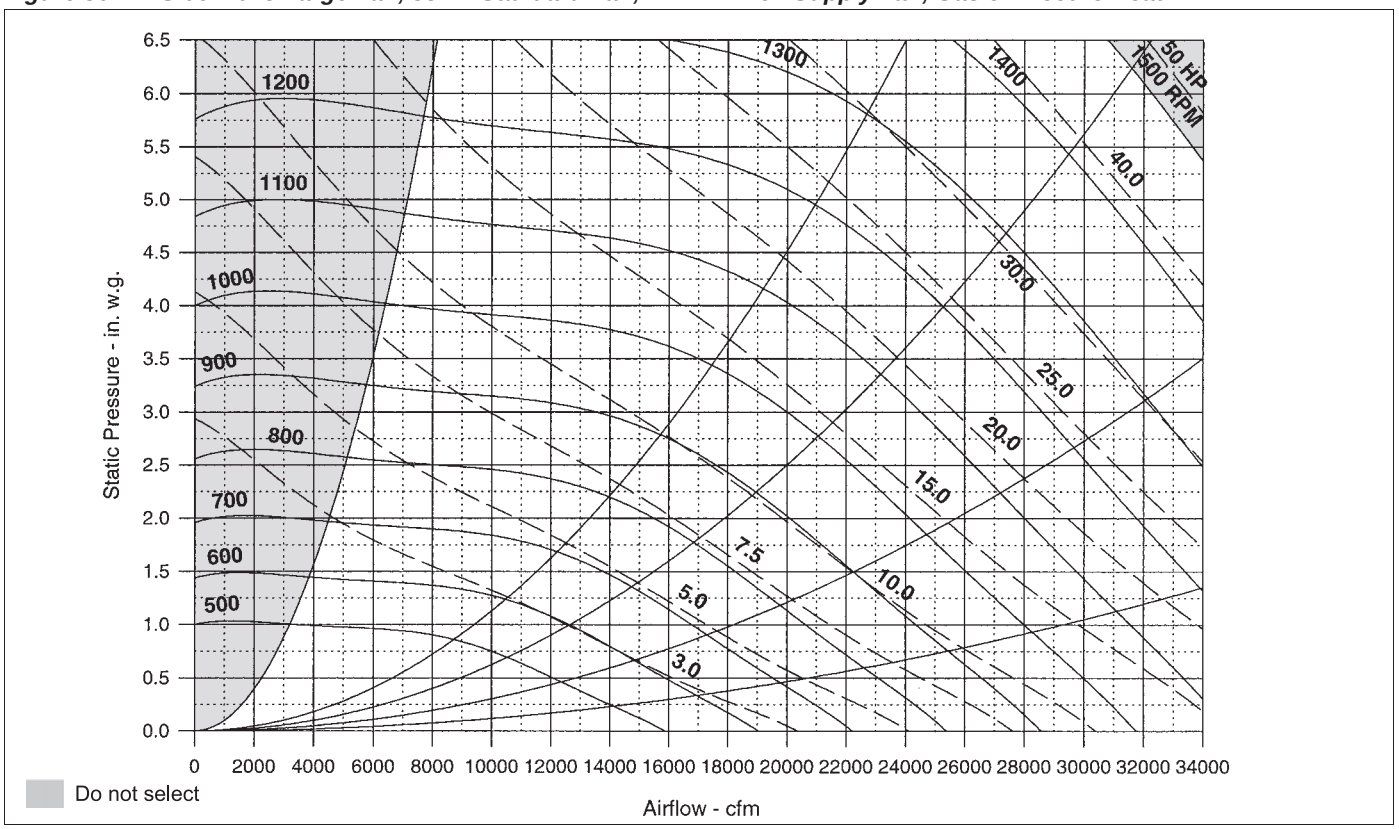
Note: Maximum allowable static pressure at fan bulkhead is 5.0 in. (i.e., supply duct ESP cannot exceed 5.0 in).

Figure 35: MPS 062–075 30-in. Standard Fan, DWDI Airfoil Supply Fan



Note: Maximum allowable static pressure at fan bulkhead is 5.0 in. (i.e., supply duct ESP cannot exceed 5.0 in).

Figure 36: MPS 062–075 Large Fan, 33-in. Standard Fan, DWDI Airfoil Supply Fan, Gas or Electric Heat



Note: Maximum allowable static pressure at fan bulkhead is 5.0 in. (i.e., supply duct ESP cannot exceed 5.0 in).

Figure 37: 18" Energy Recovery SWSI Air Foil Exhaust Fan Curve

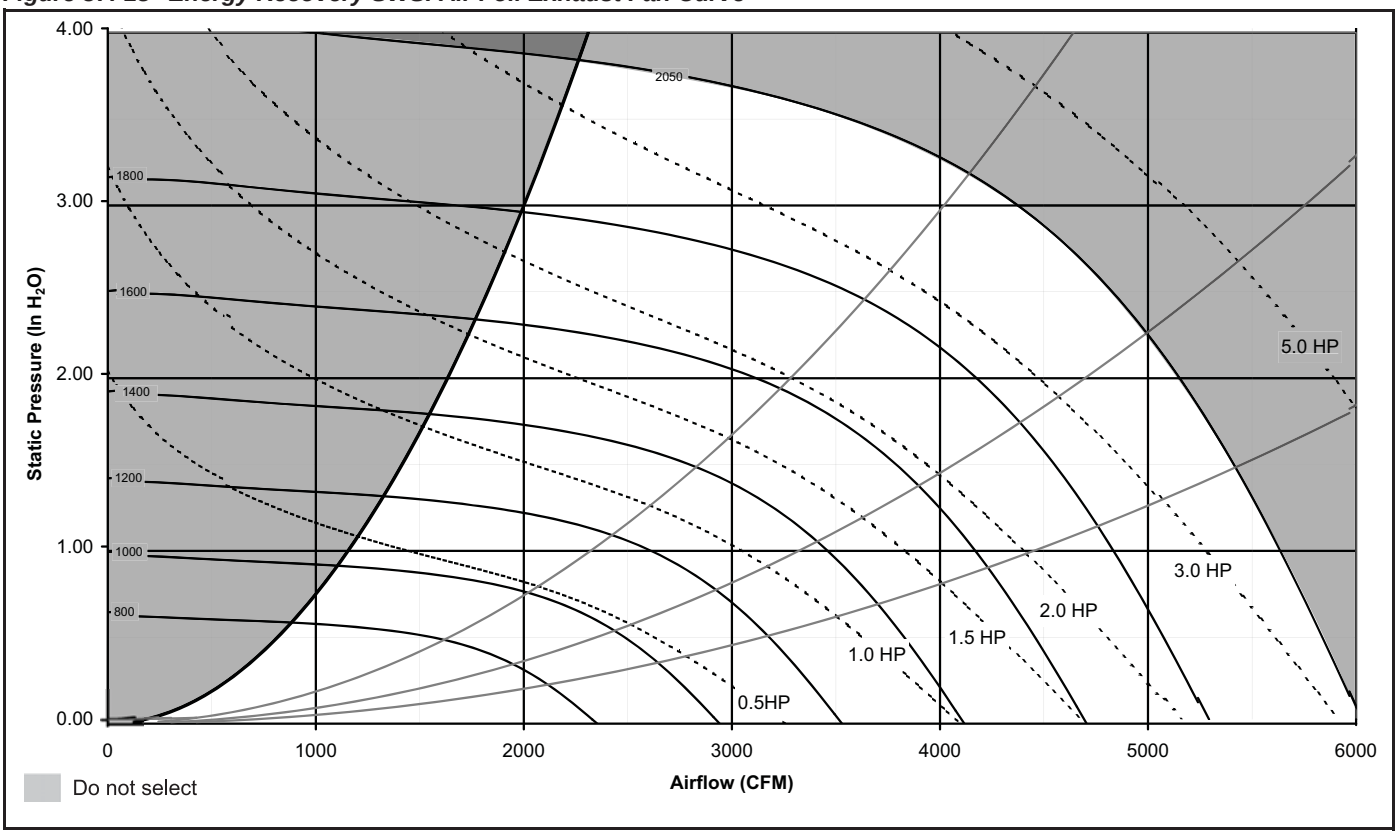


Figure 38: 22" Energy Recovery SWSI Air Foil Exhaust Fan Curve

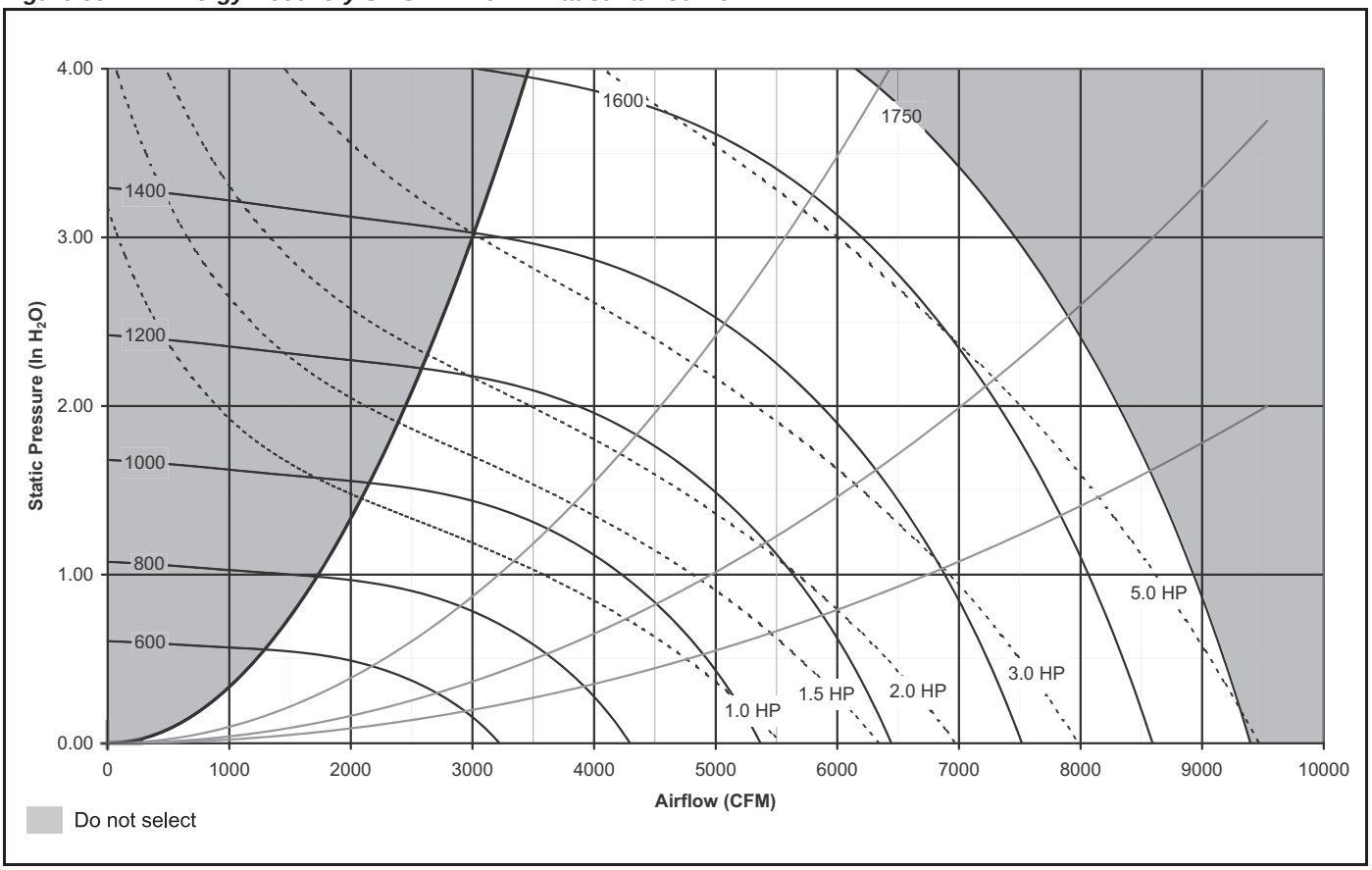


Figure 39: Energy Recovery Dual SWSI Air Foil Dual 18" Exhaust Fan Curve

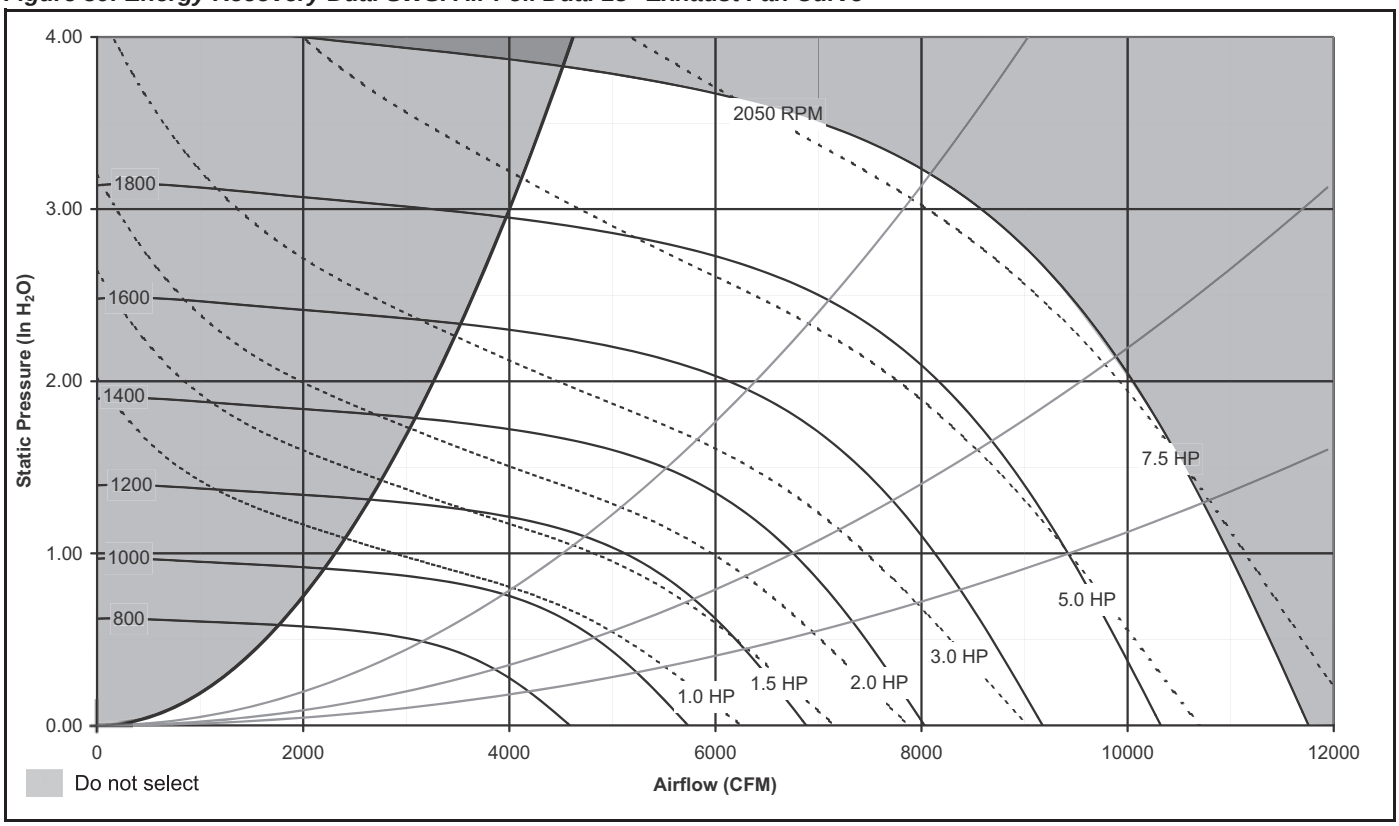
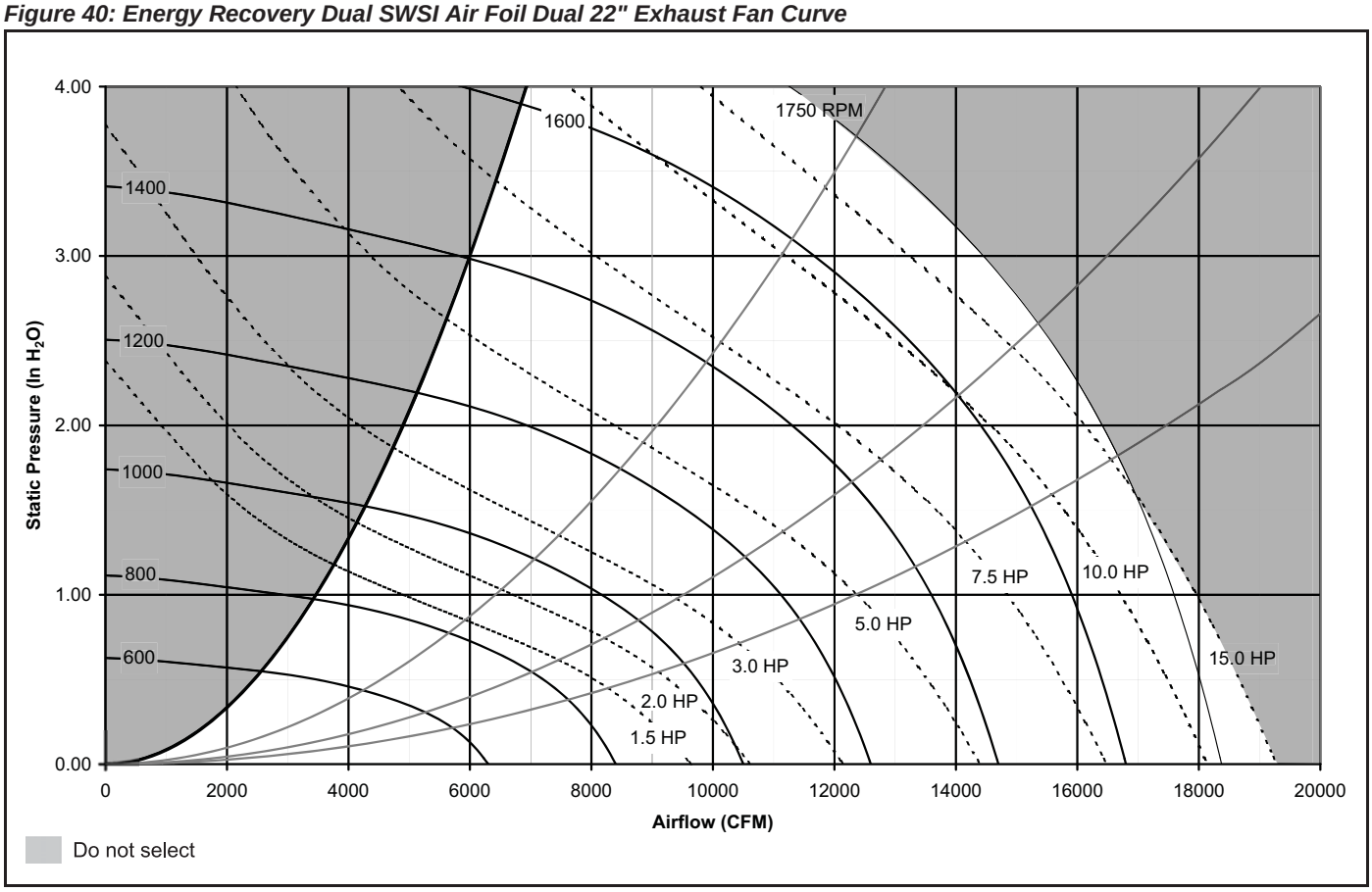


Figure 40: Energy Recovery Dual SWSI Air Foil Dual 22" Exhaust Fan Curve



MPS 015–025 Unit Dimensions

Figure 41: MPS 015–025 Cooling/Electric Heating Unit

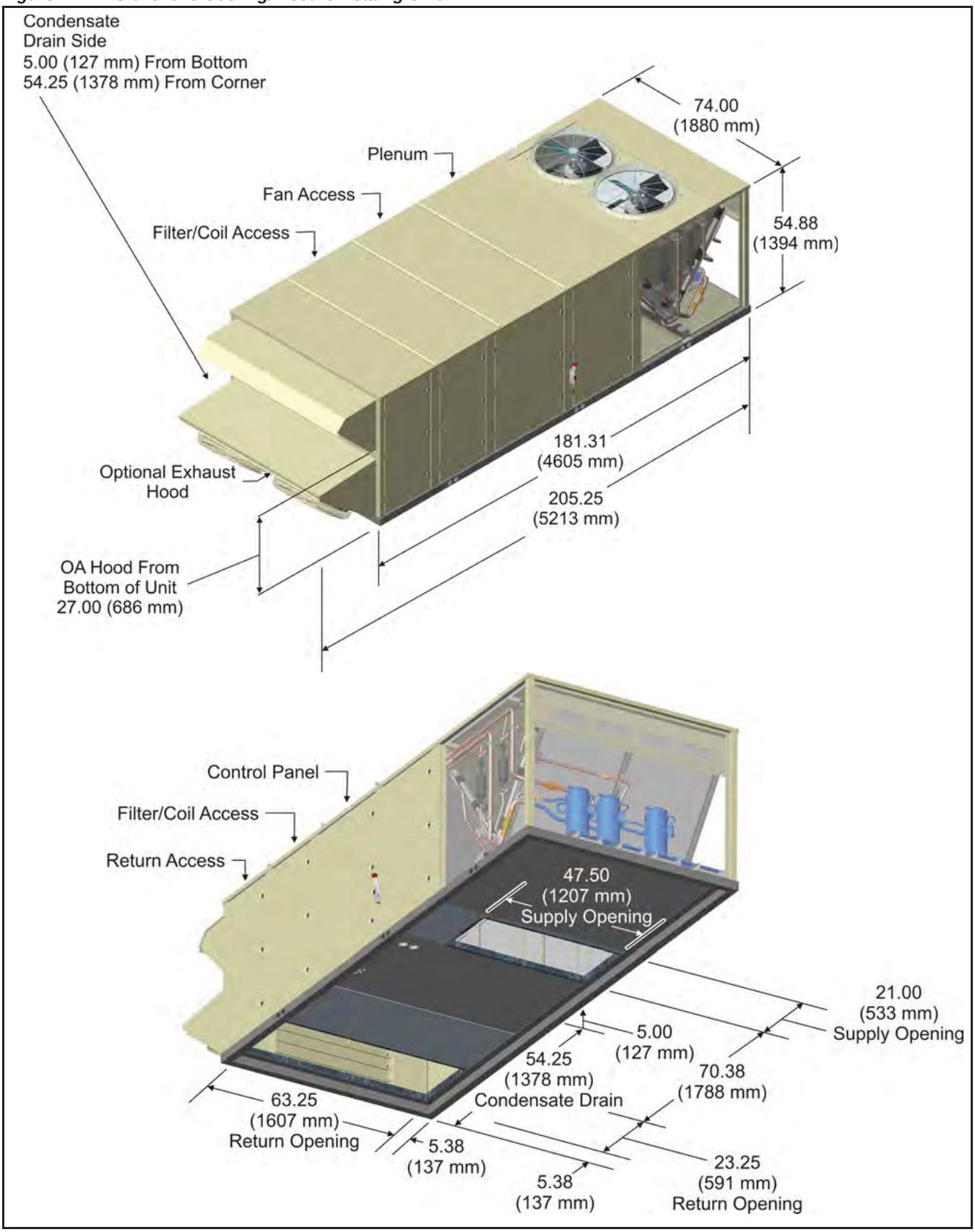


Figure 42: MPS 015–025 Cooling/Hot Water Heating Unit

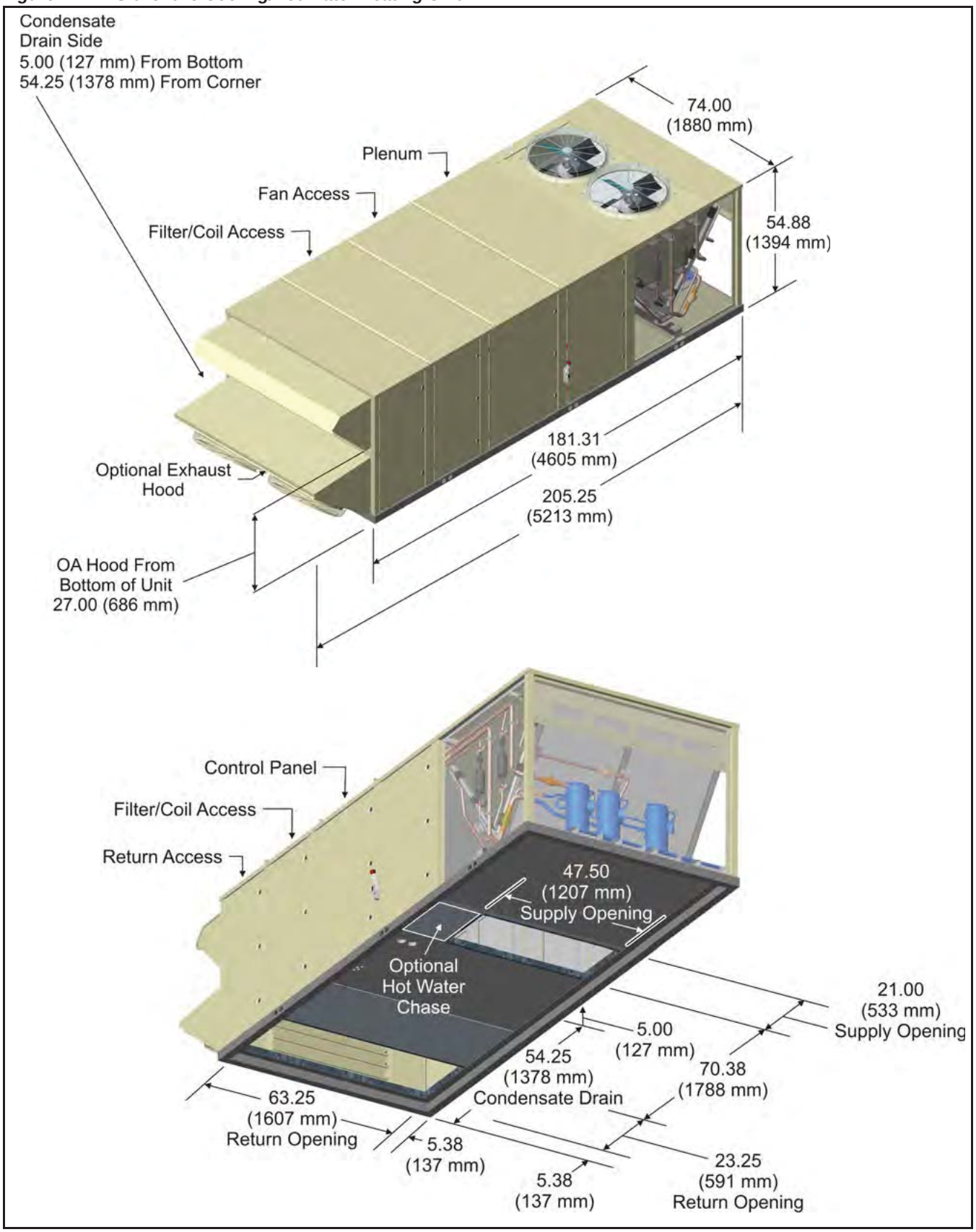
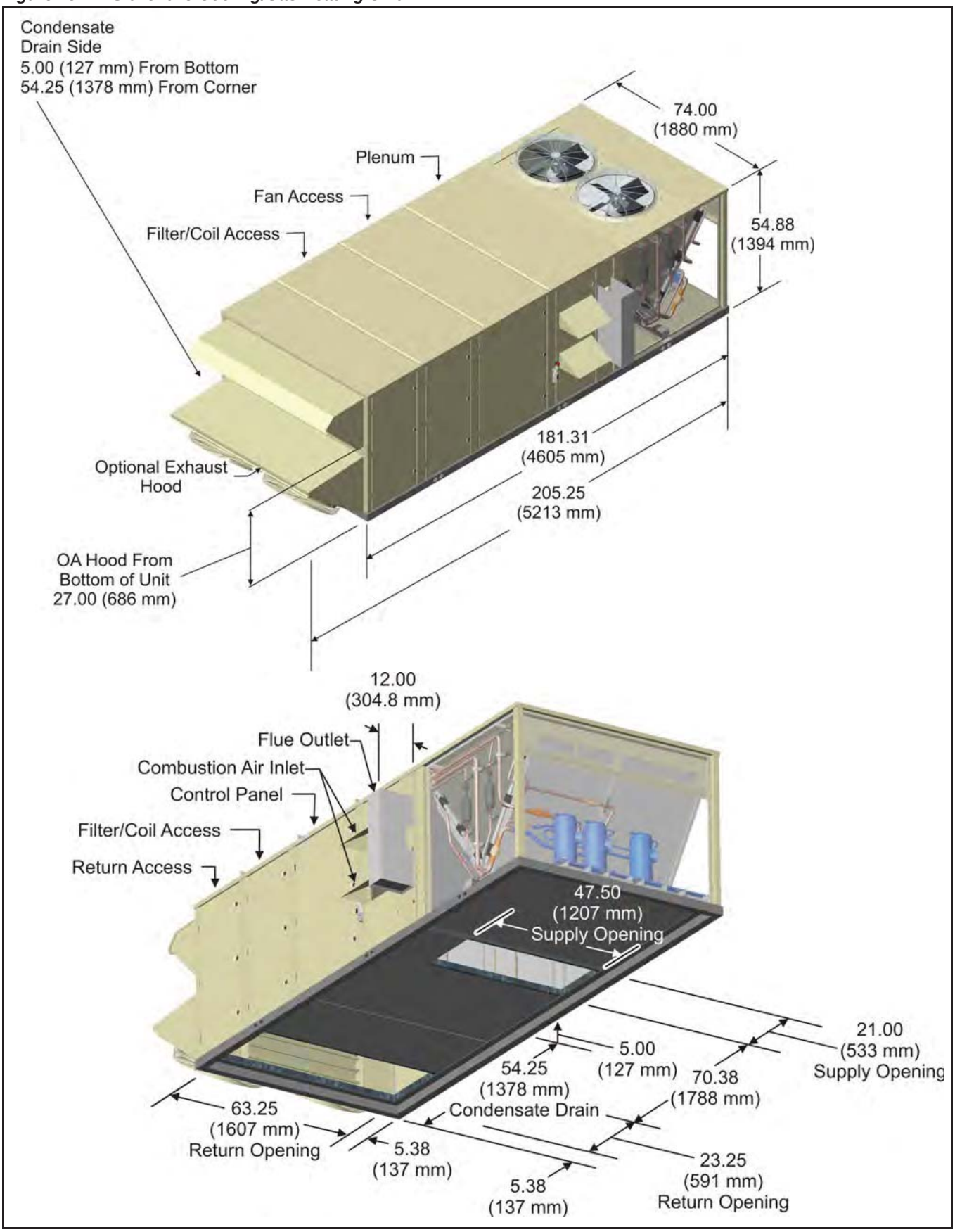
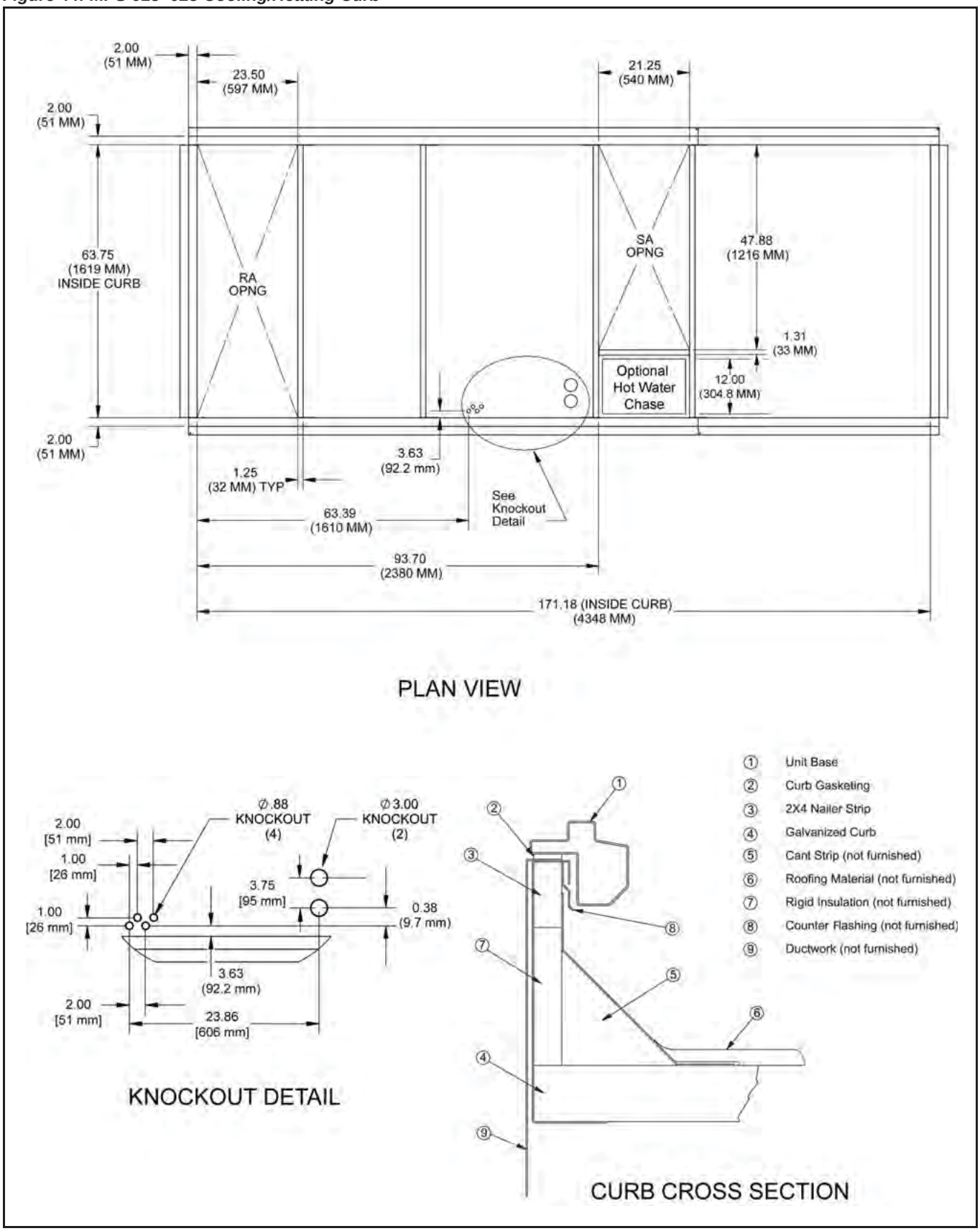


Figure 43: MPS 015–025 Cooling/Gas Heating Unit



MPS 015–025 Roof Curb Dimensions

Figure 44: MPS 015–025 Cooling/Heating Curb



MPS 015–025 with Energy Recovery Wheel Unit Dimensions

Figure 45: MPS 015–025 Cooling Only

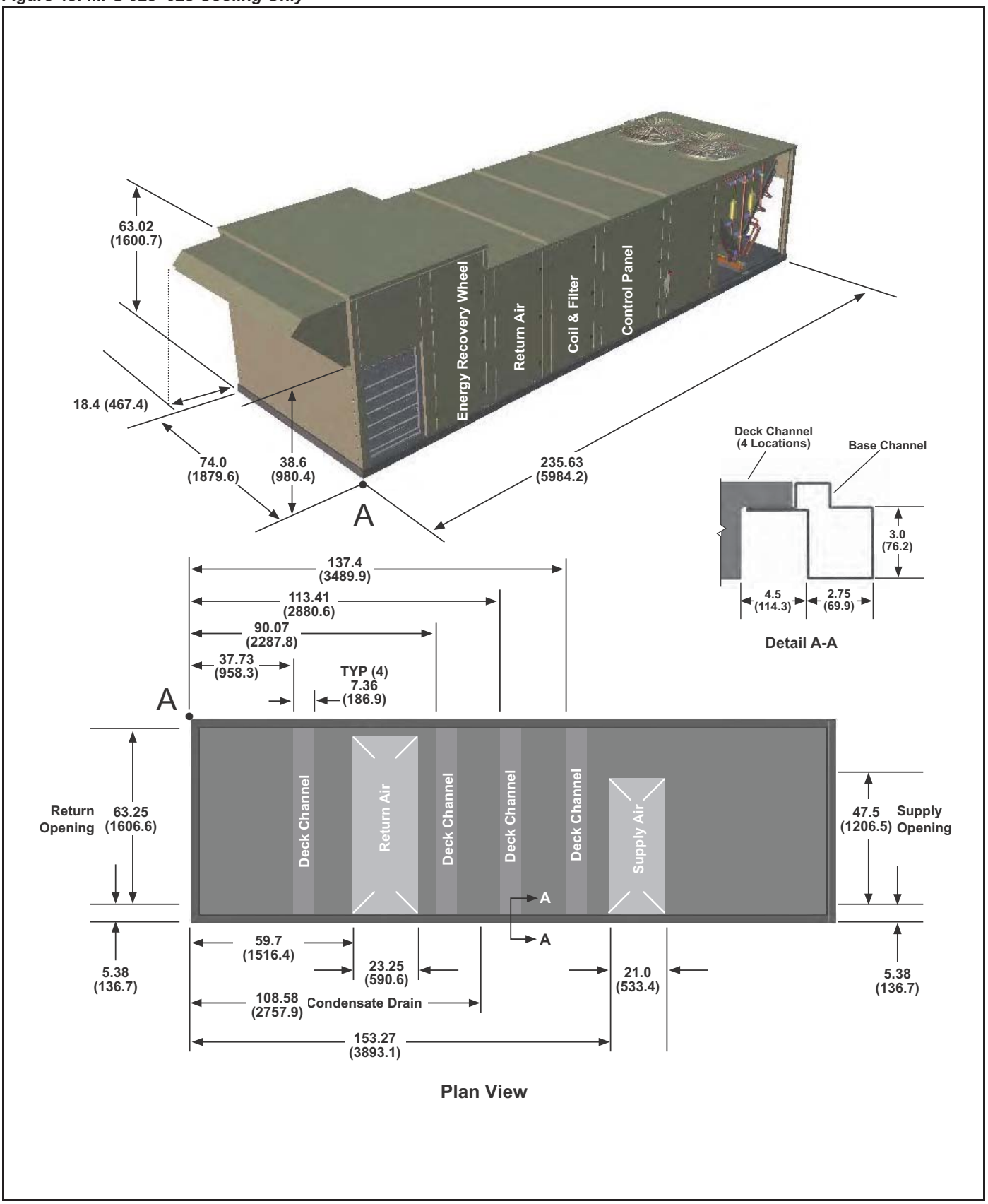
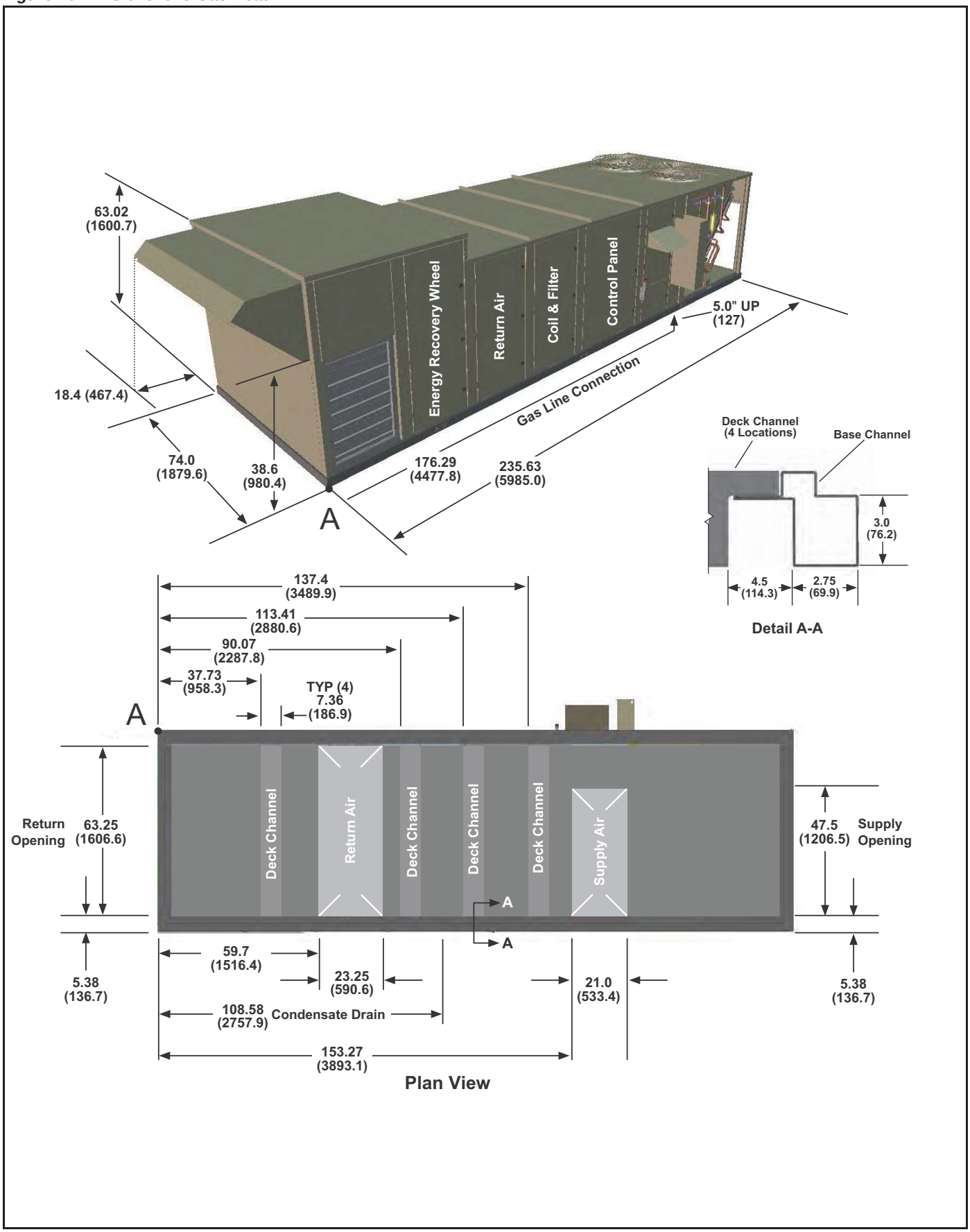
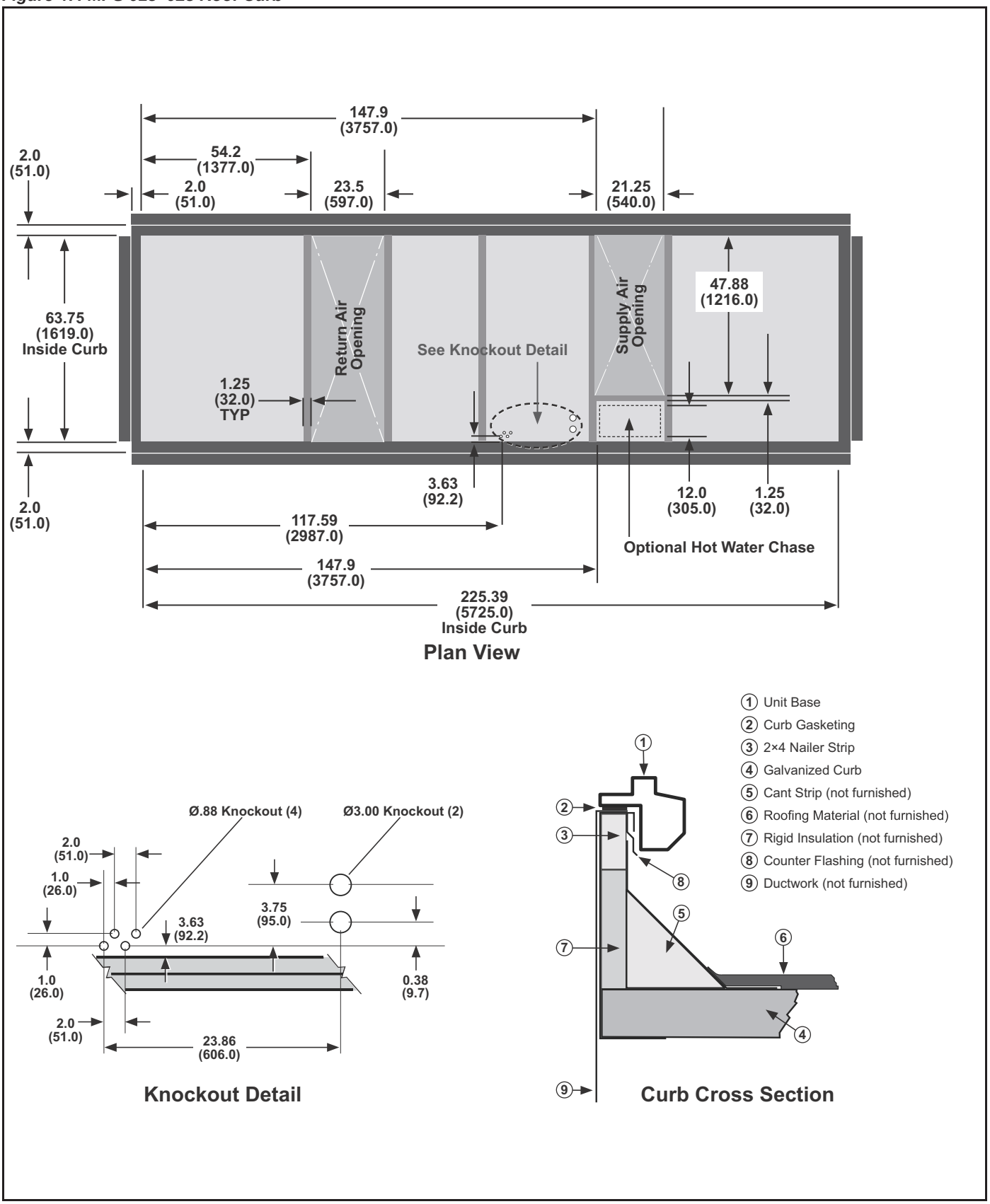


Figure 46: MPS 015–025 Gas Heat



MPS 015–025 Units with Energy Recovery Wheel Roof Curb Dimensions

Figure 47: MPS 015–025 Roof Curb



MPS 030–035 Unit Dimensions

Figure 48: MPS 030–035 Cooling/Electric Heating Unit

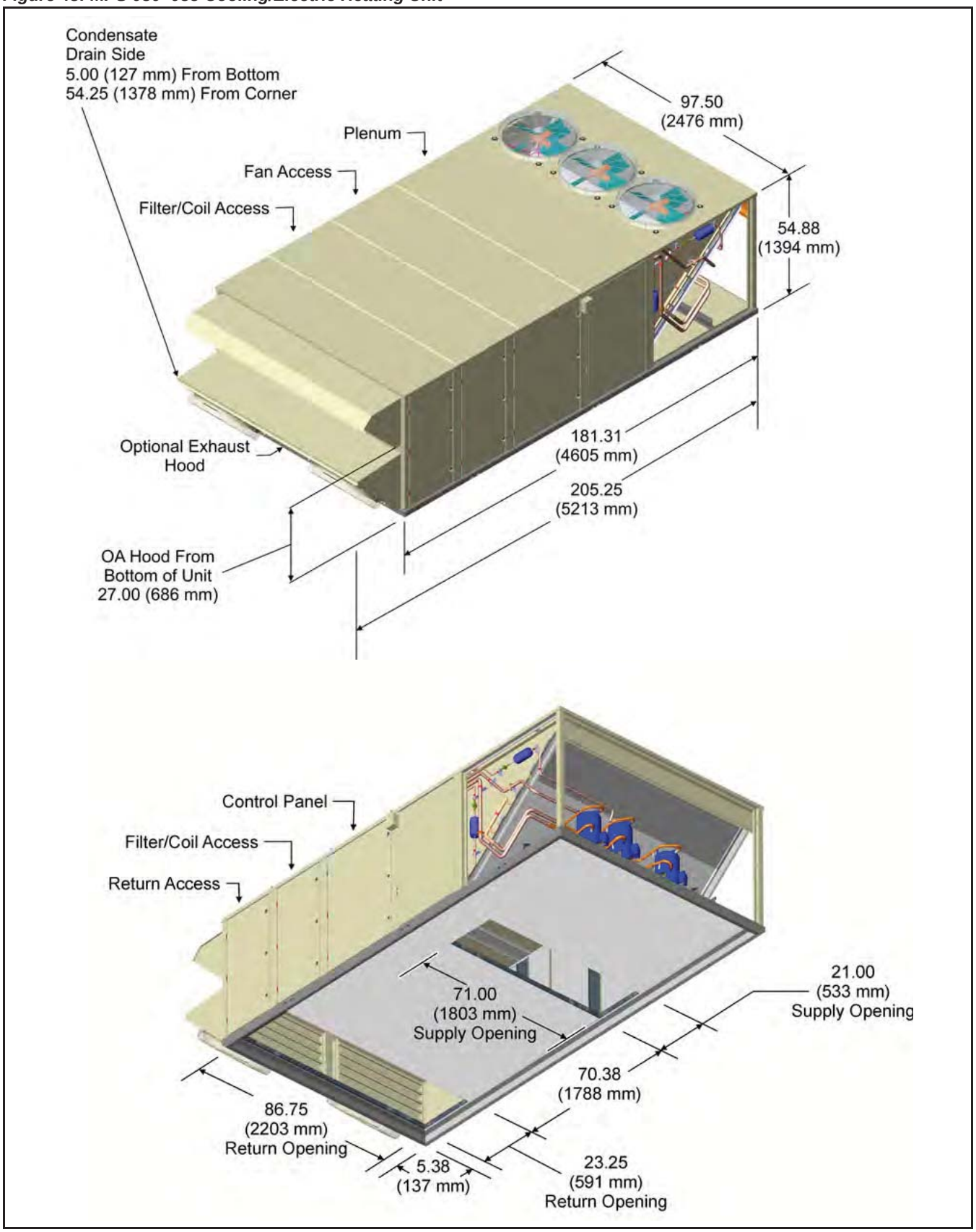


Figure 49: MPS 030–035 Cooling/Hot Water Heating Unit

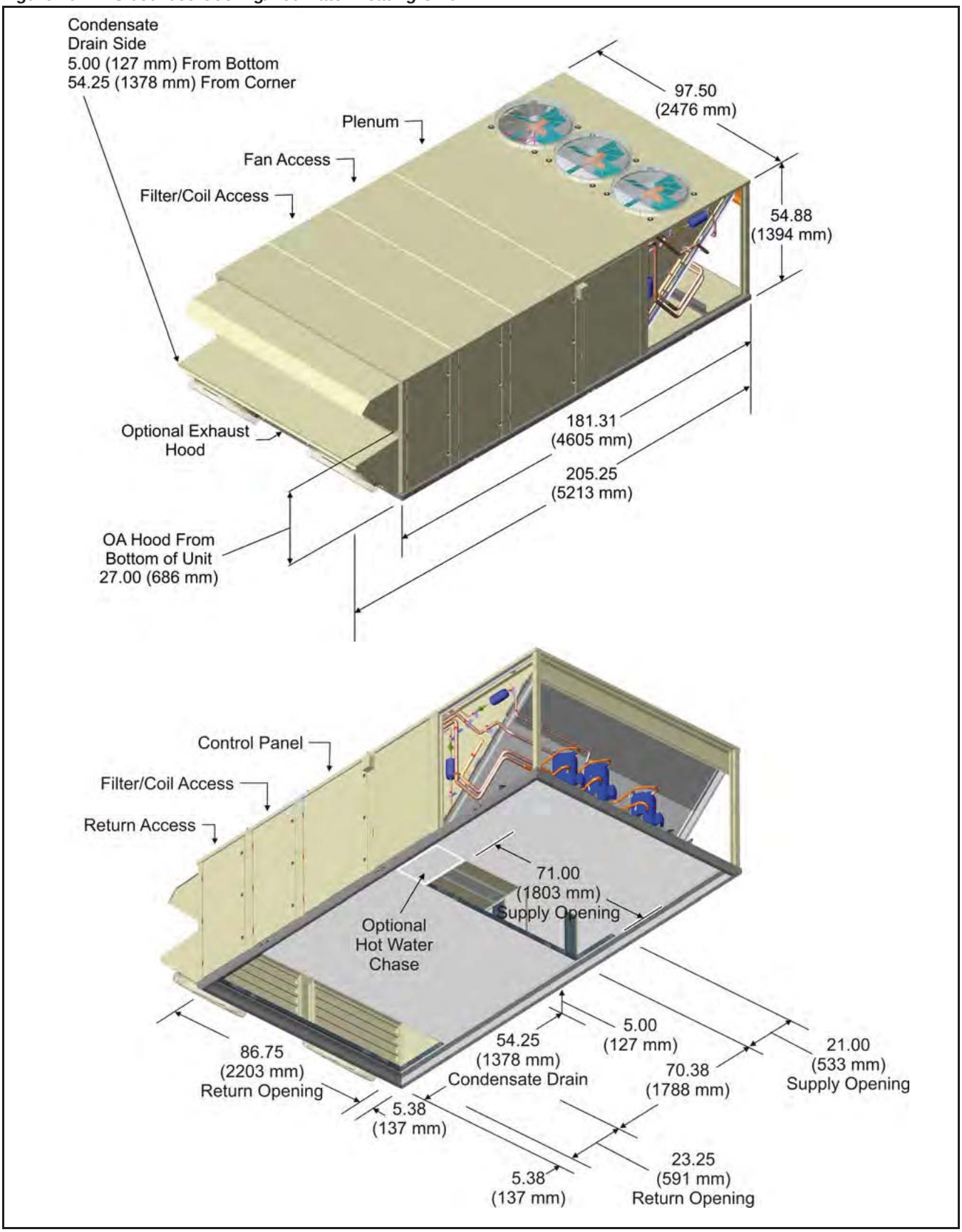
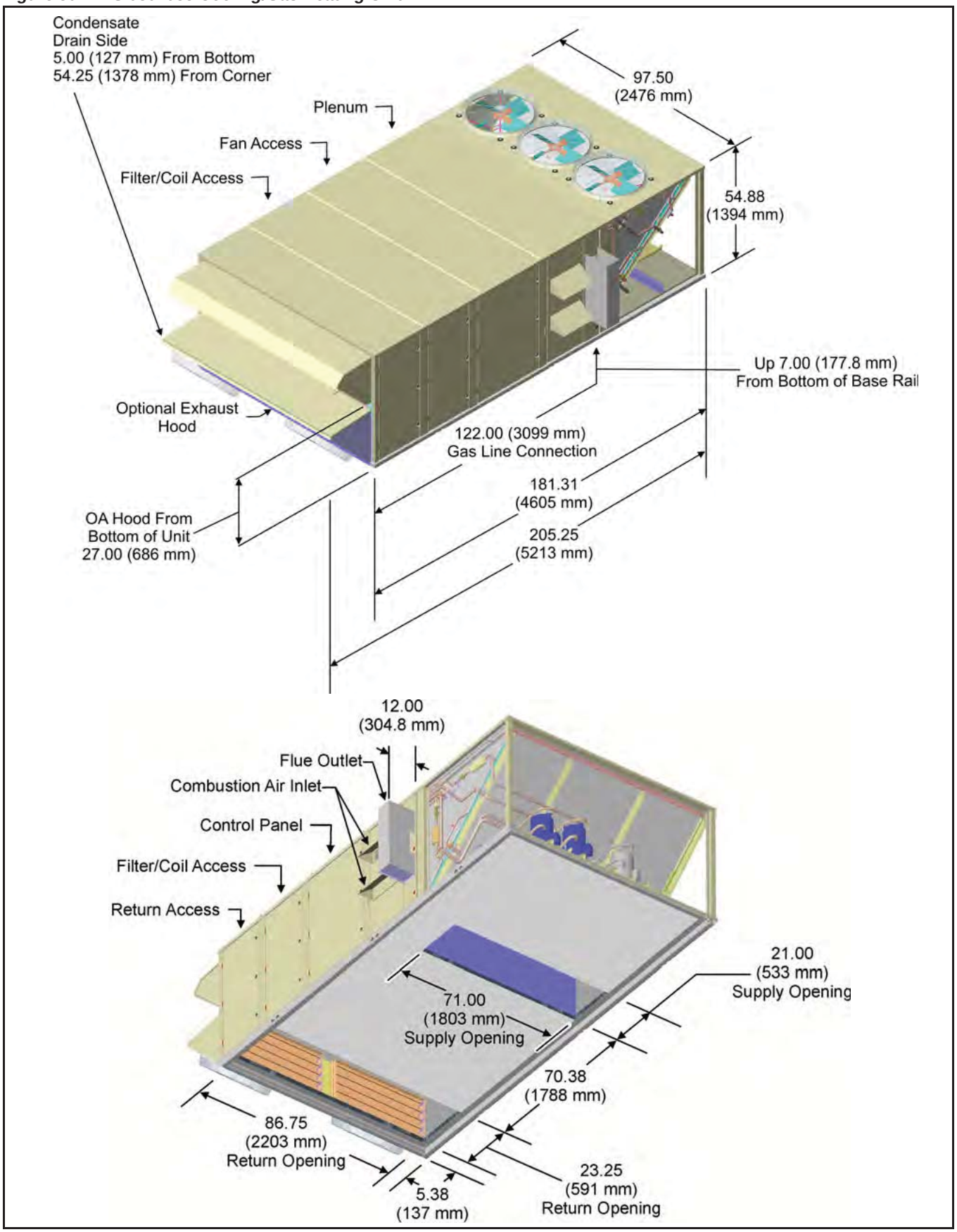
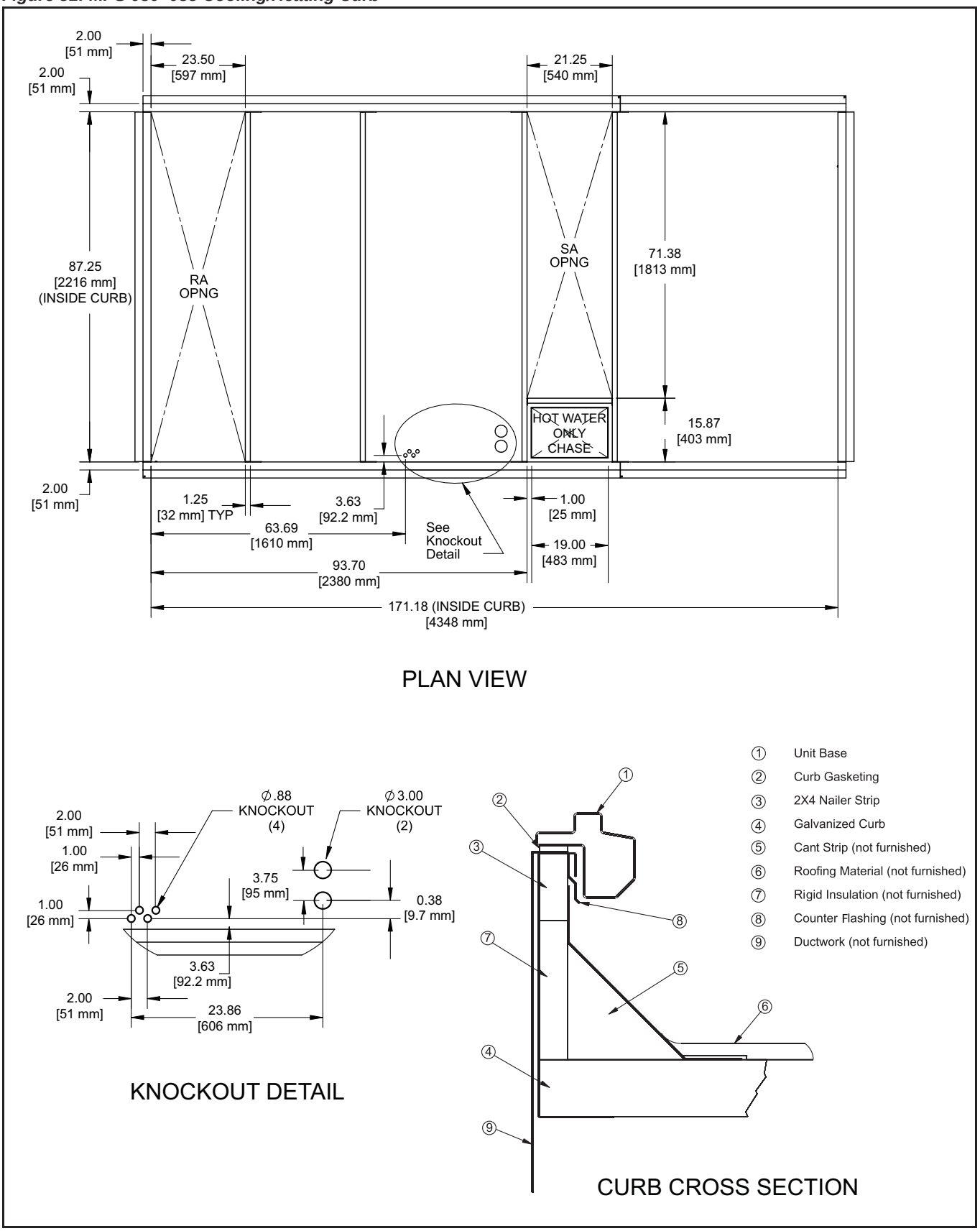


Figure 50: MPS 030–035 Cooling/Gas Heating Unit



MPS 030–035 Roof Curb Dimensions

Figure 51: MPS 030–035 Cooling/Heating Curb



MPS 030–035 with Energy Recovery Wheel Unit Dimensions

Figure 52: MPS 030–035 Cooling Only, Standard Diameter Energy Recovery Wheel

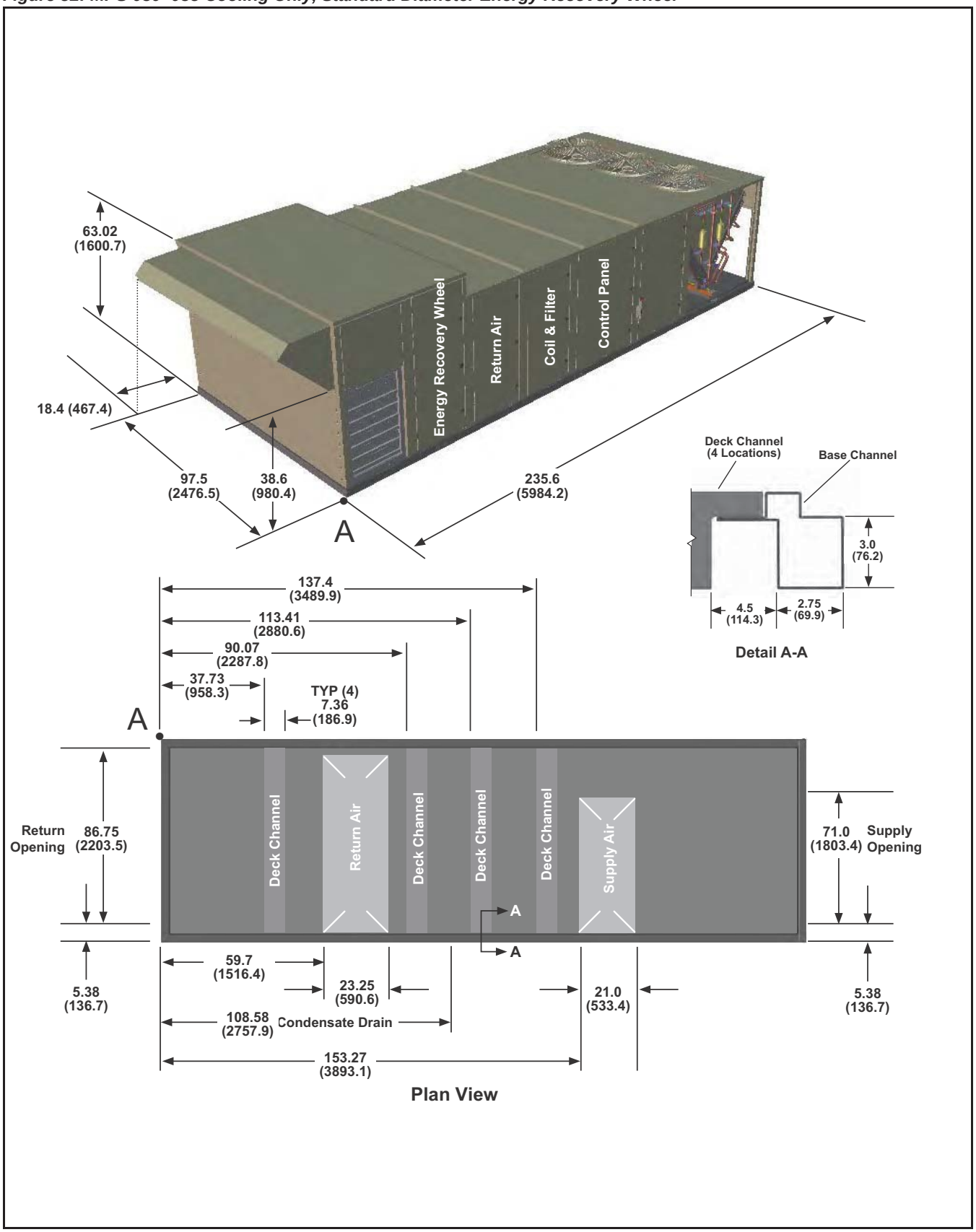


Figure 53: MPS 030–035 Cooling Only, Large Diameter Energy Recovery Wheel

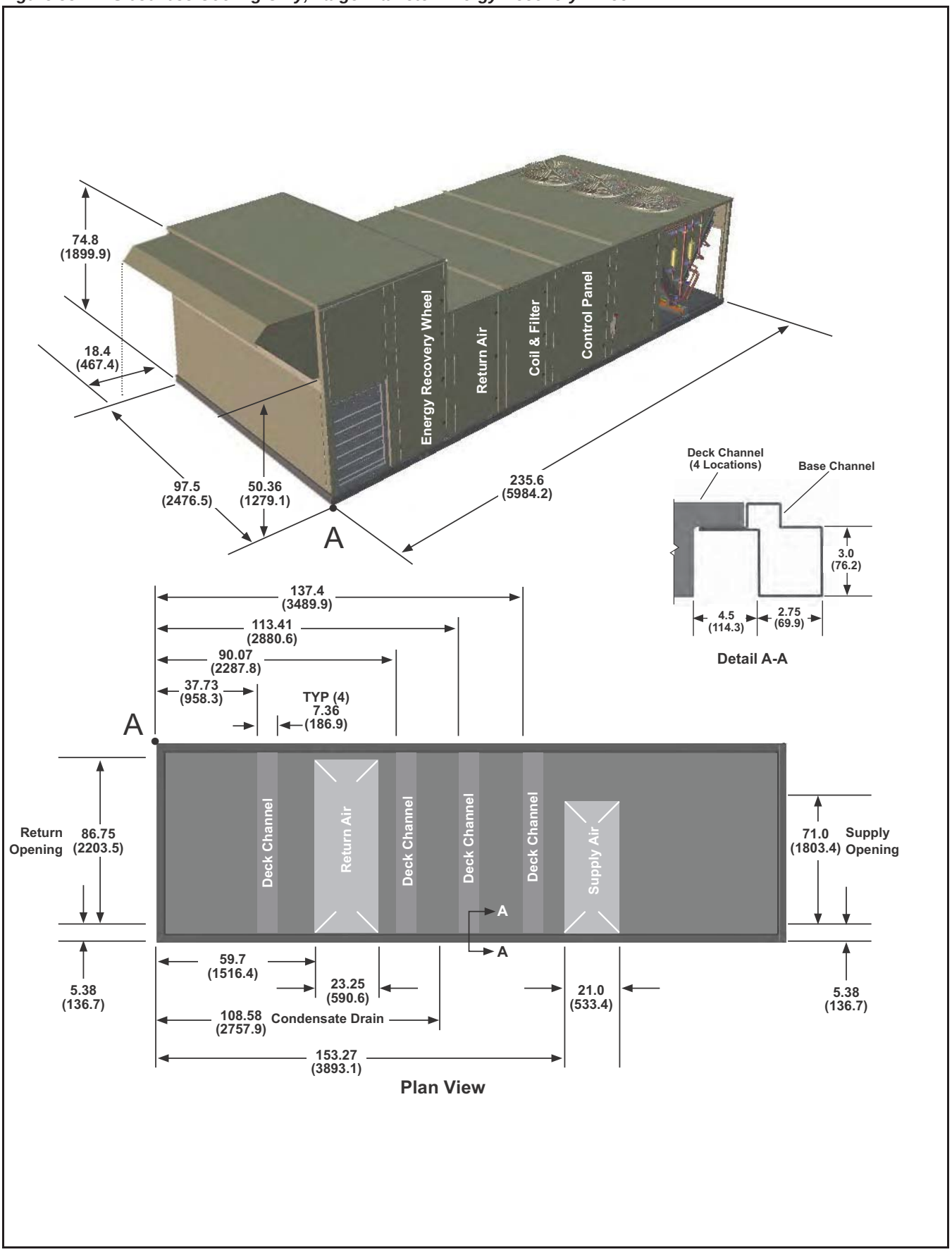


Figure 54: MPS 030–035 Gas Heat, Standard Diameter Energy Recovery Wheel

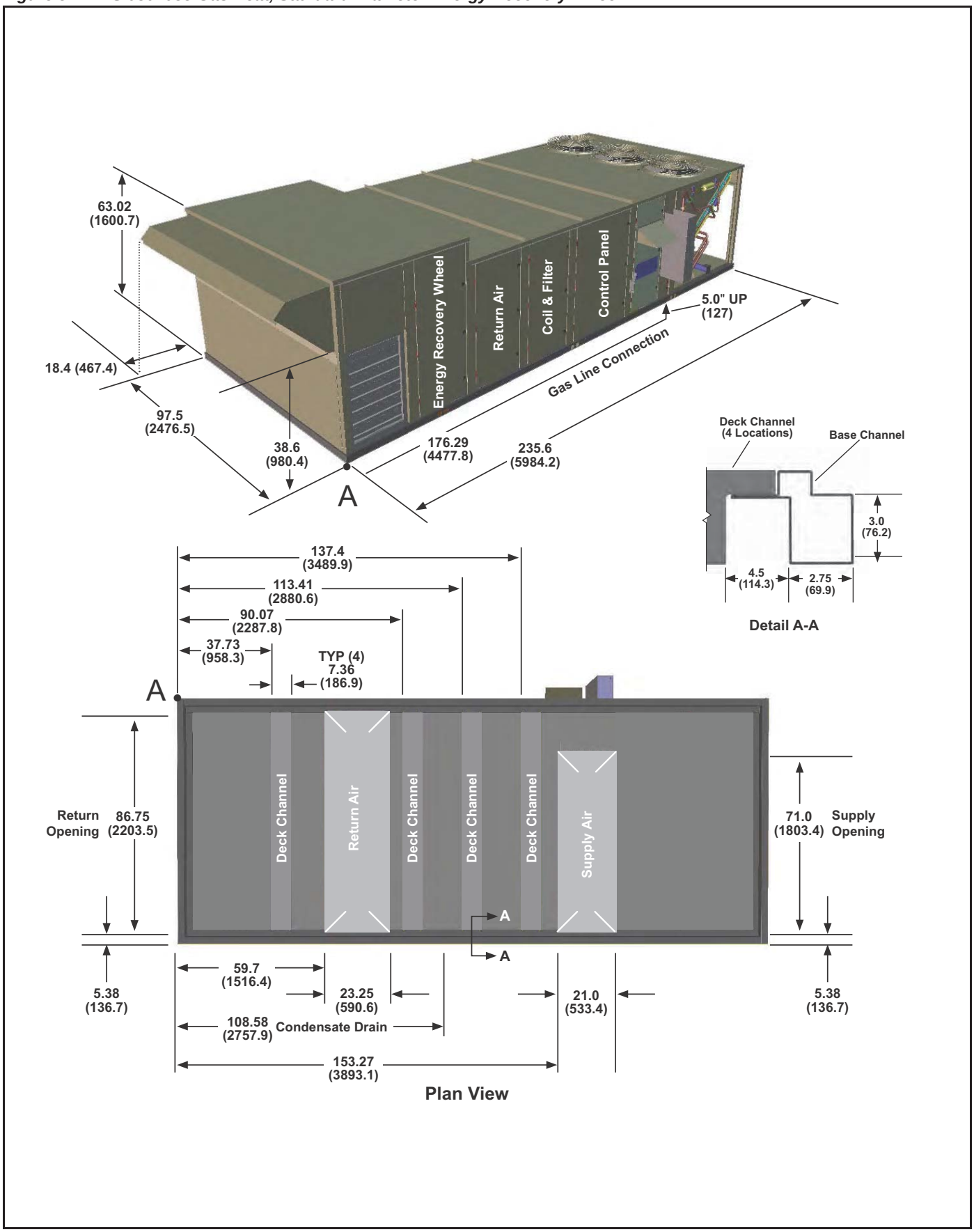
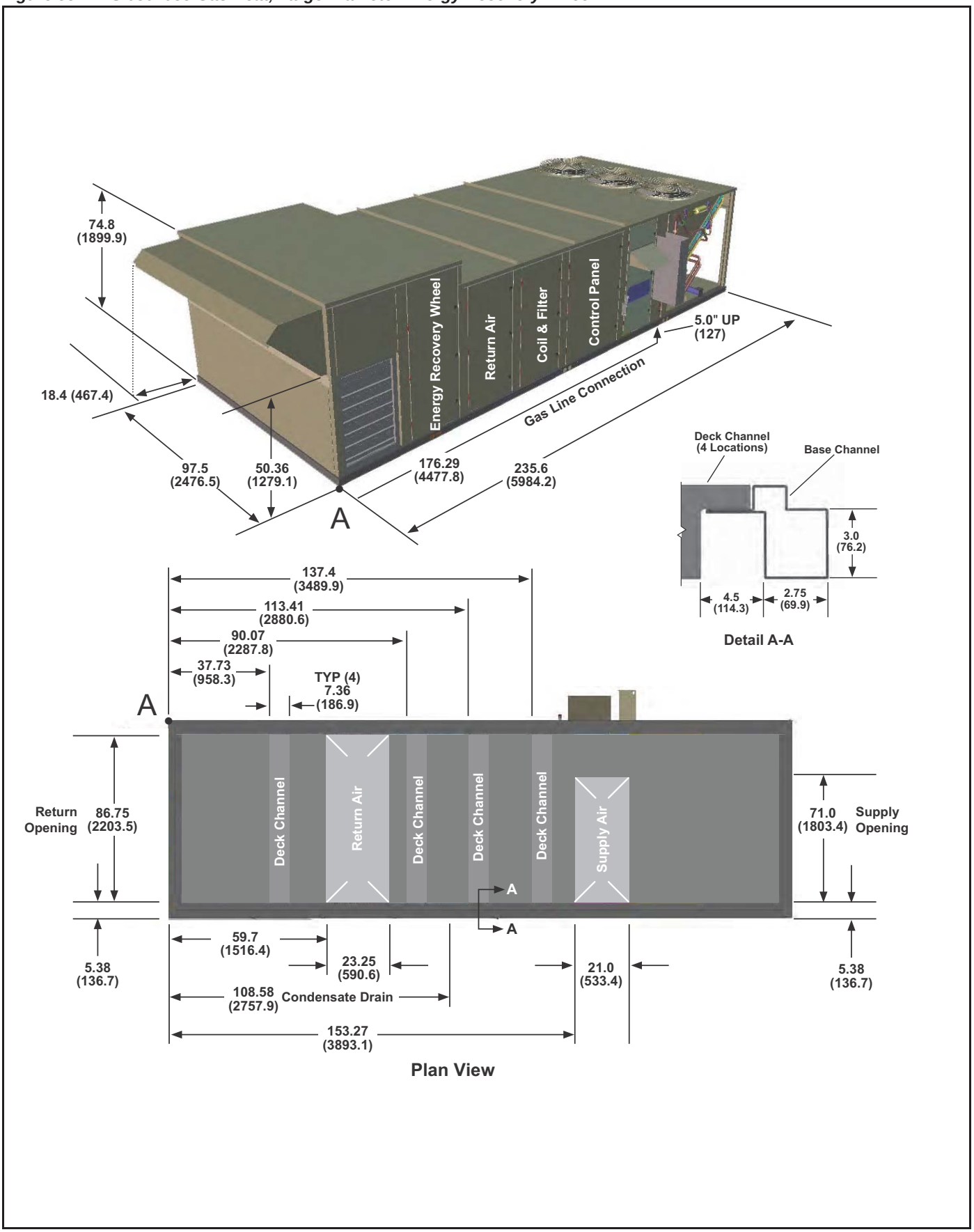
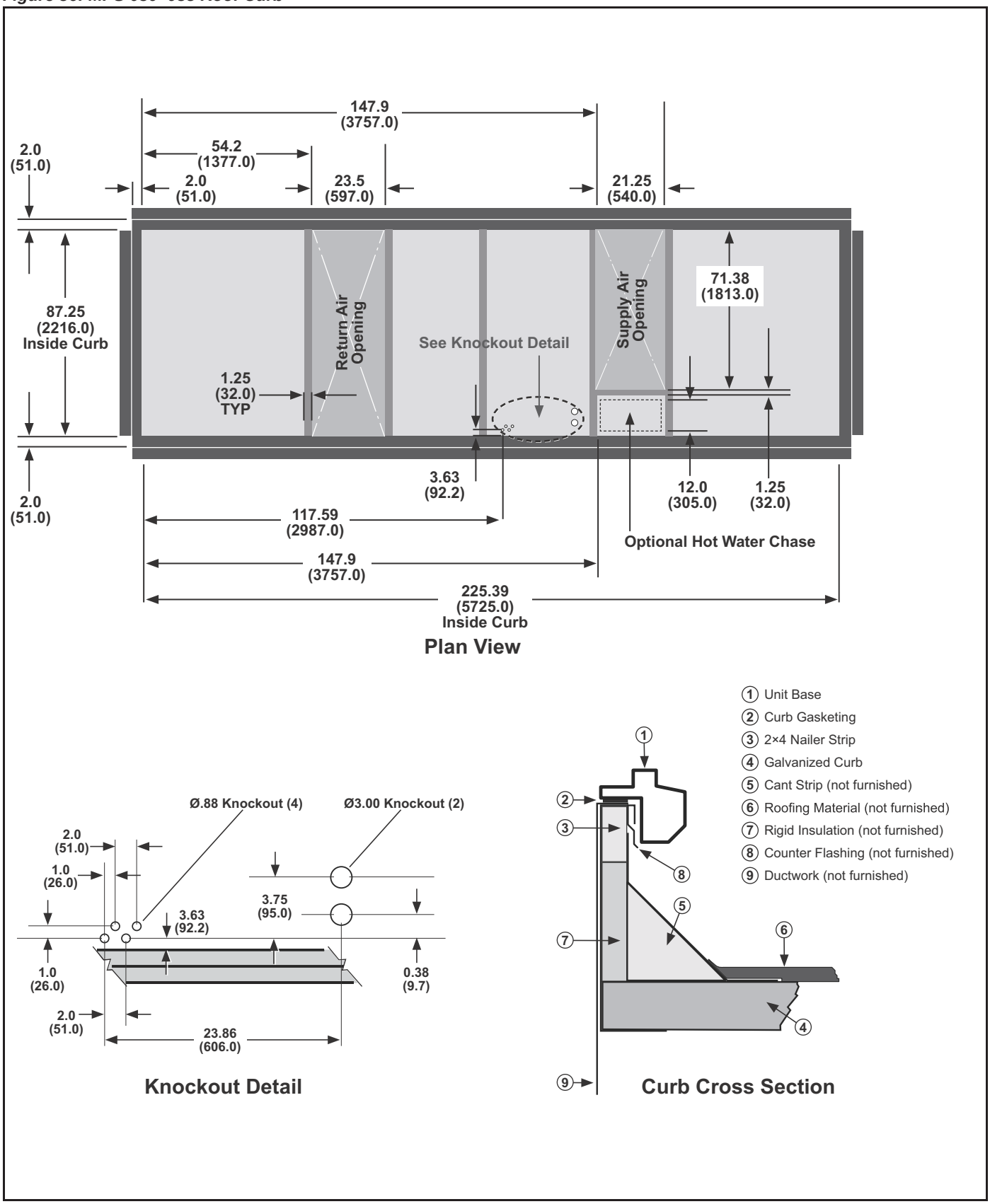


Figure 55: MPS 030–035 Gas Heat, Large Diameter Energy Recovery Wheel



MPS 030–035 Units with Energy Recovery Wheel Roof Curb Dimensions

Figure 56: MPS 030–035 Roof Curb



MPS 040–050 Unit Dimensions

Figure 57: MPS 040–050 Cooling/Electric Heating Unit

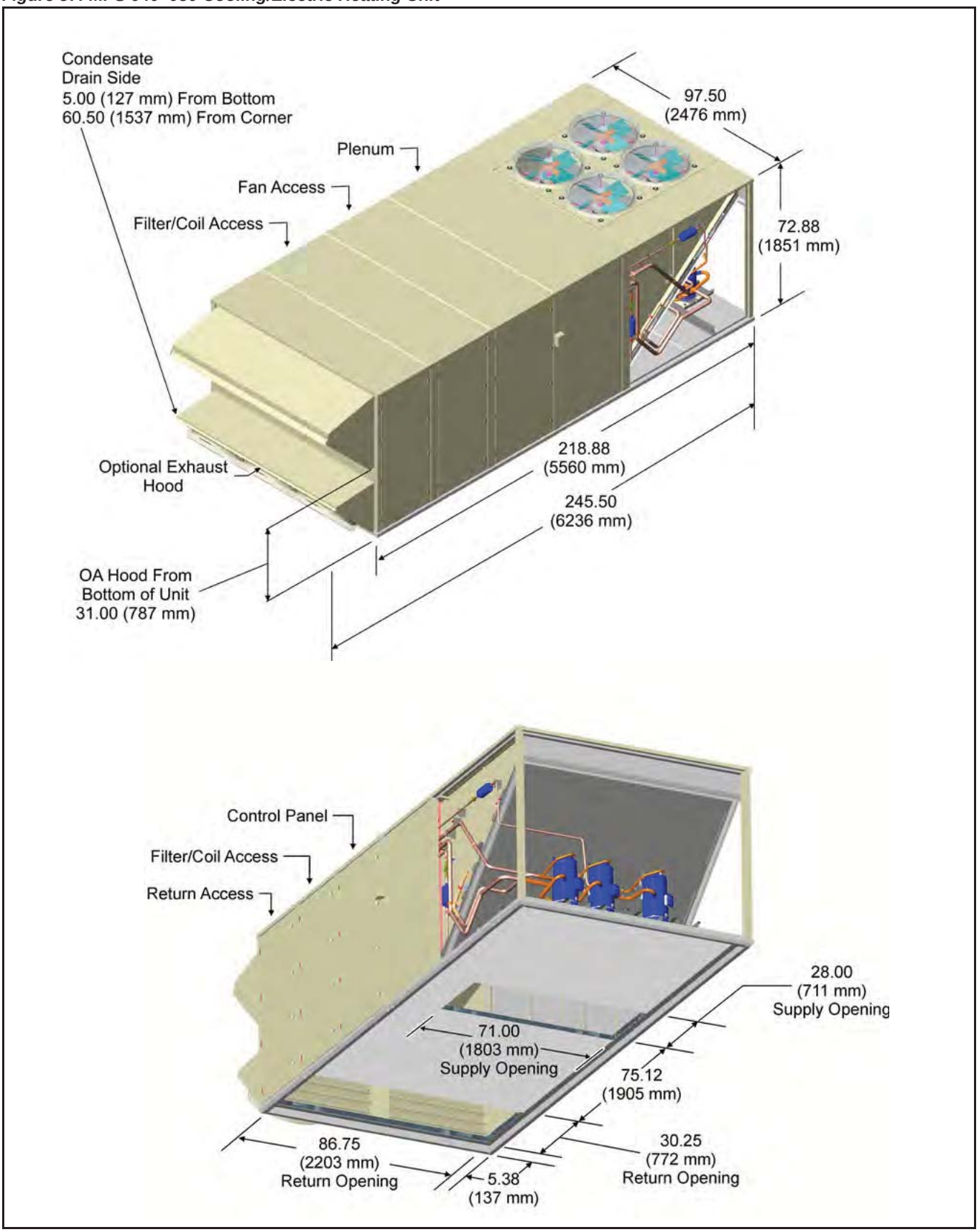


Figure 58: MPS 040–050 Cooling/Hot Water Heating Unit

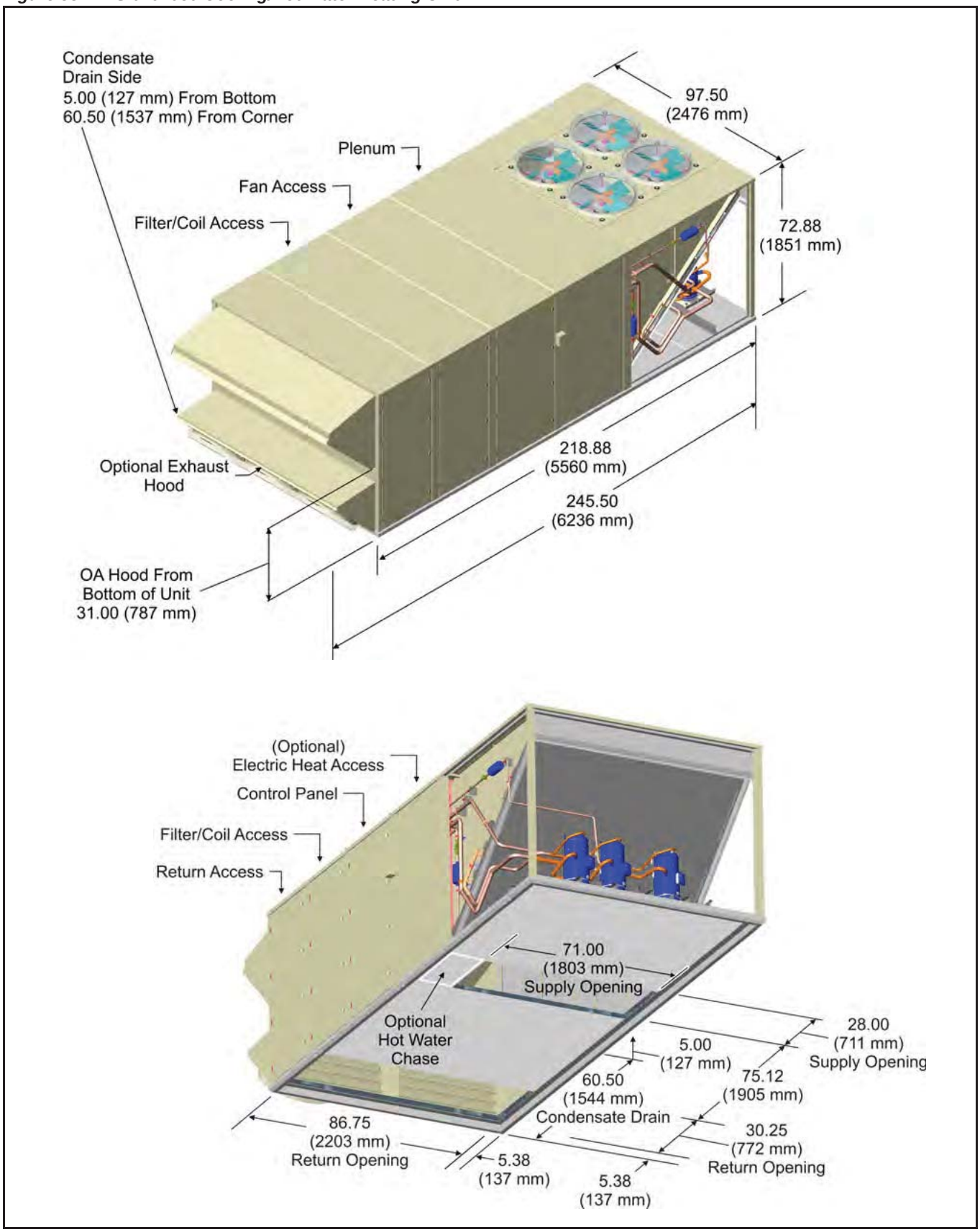
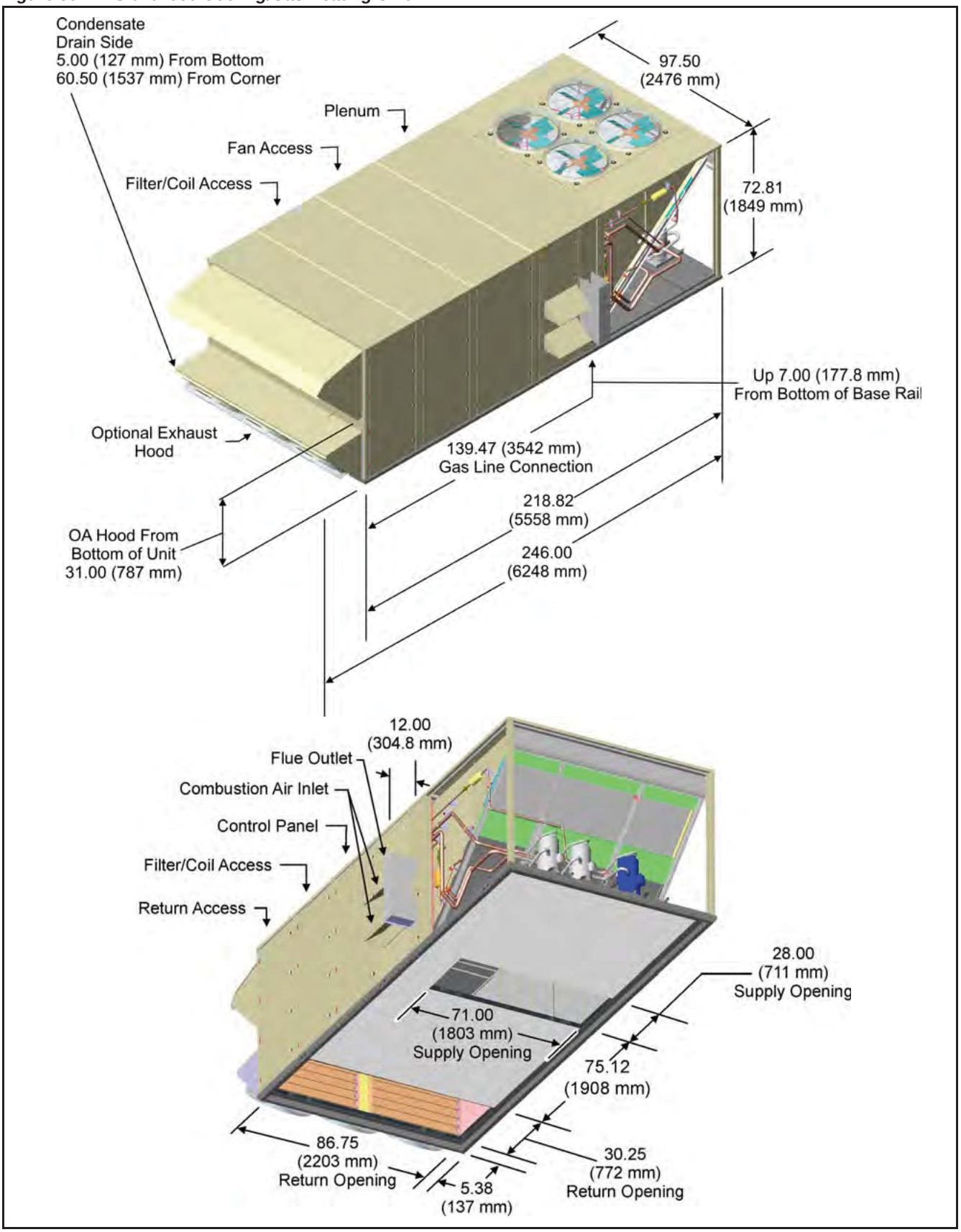
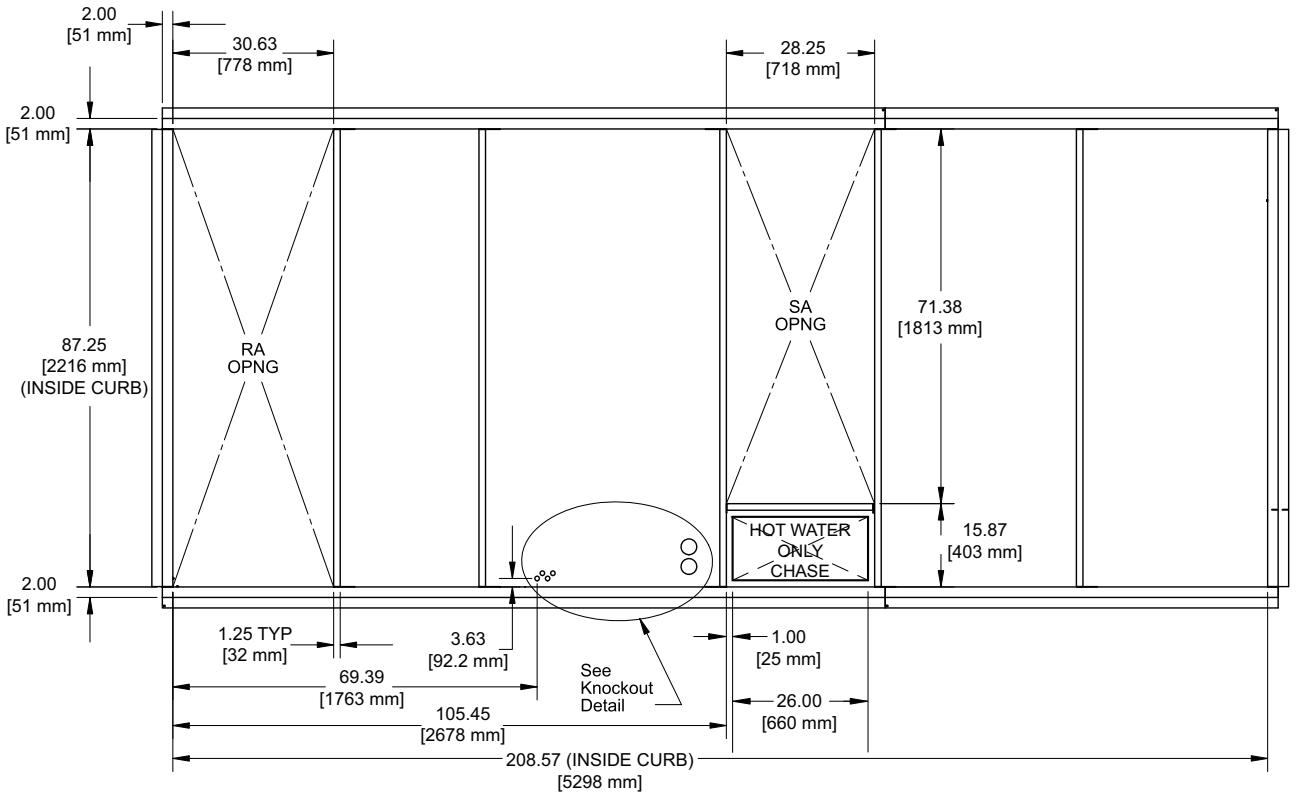


Figure 59: MPS 040–050 Cooling/Gas Heating Unit

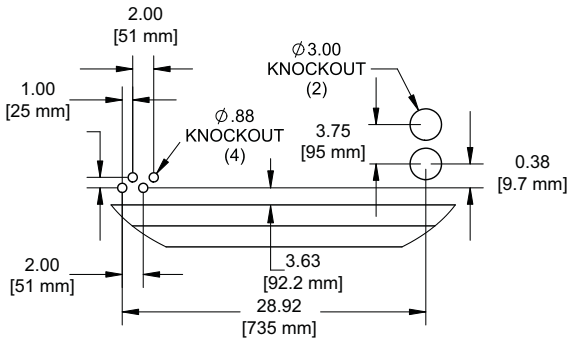


MPS 040–050 Roof Curb Dimensions

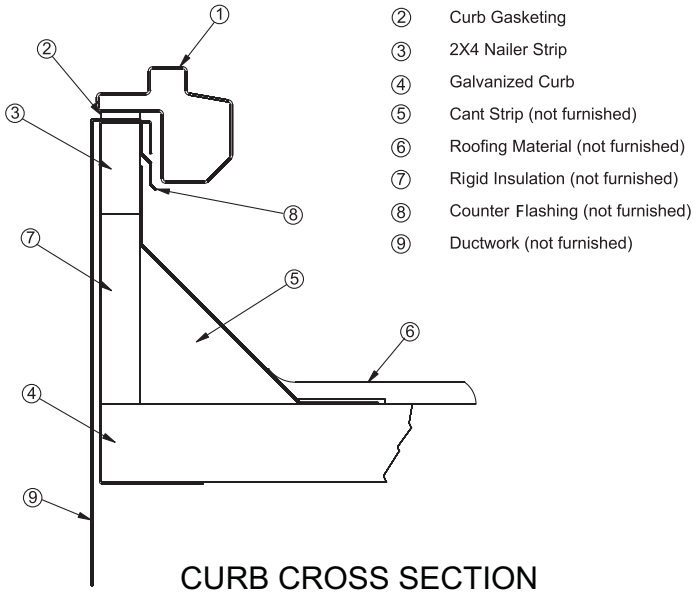
Figure 60: MPS 040–050 Cooling/Heating Curb



PLAN VIEW



KNOCKOUT DETAIL



CURB CROSS SECTION

MPS 040–050 Units with Energy Recovery Wheel Dimensions

Figure 61: MPS 040–050 Cooling Only

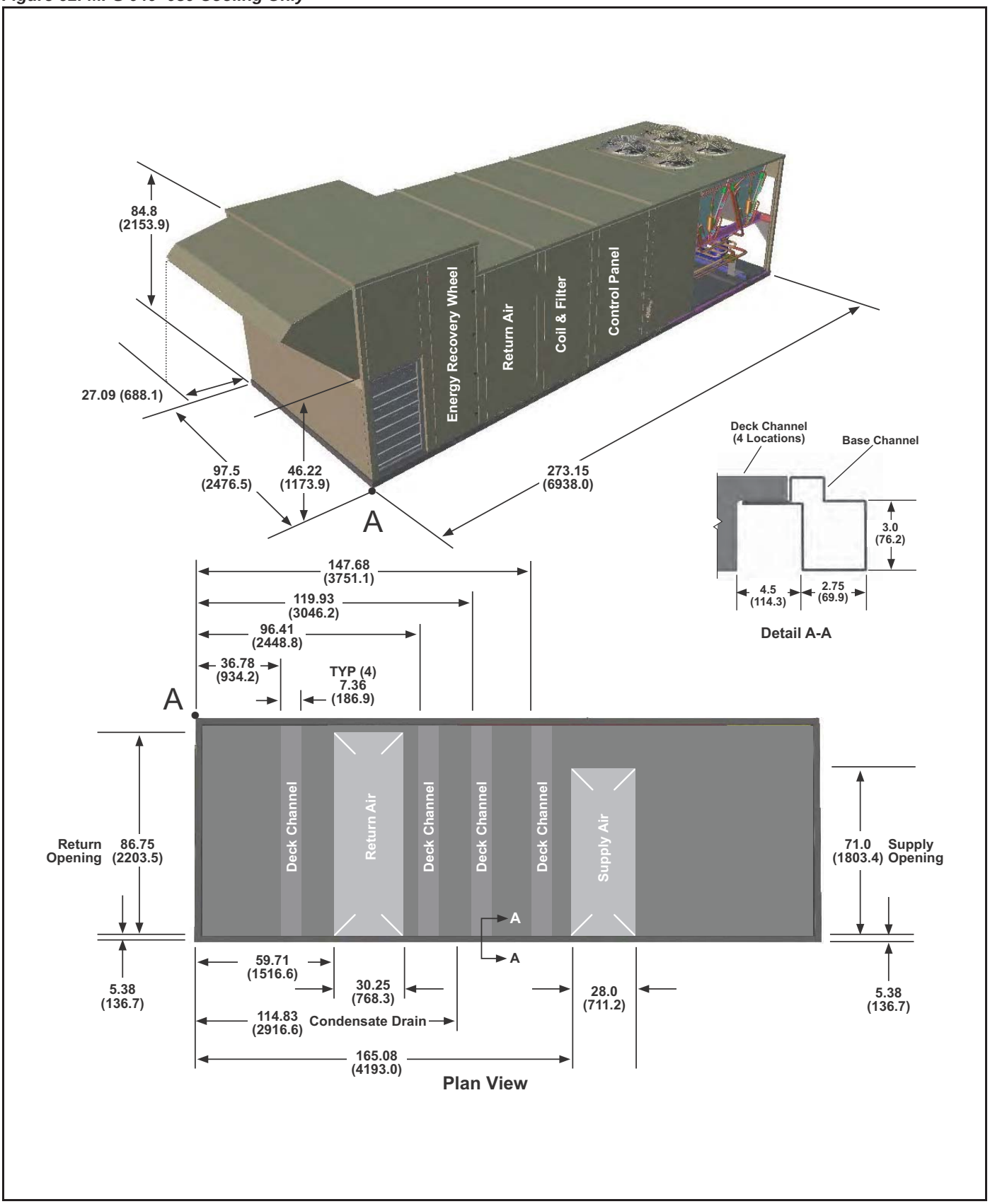
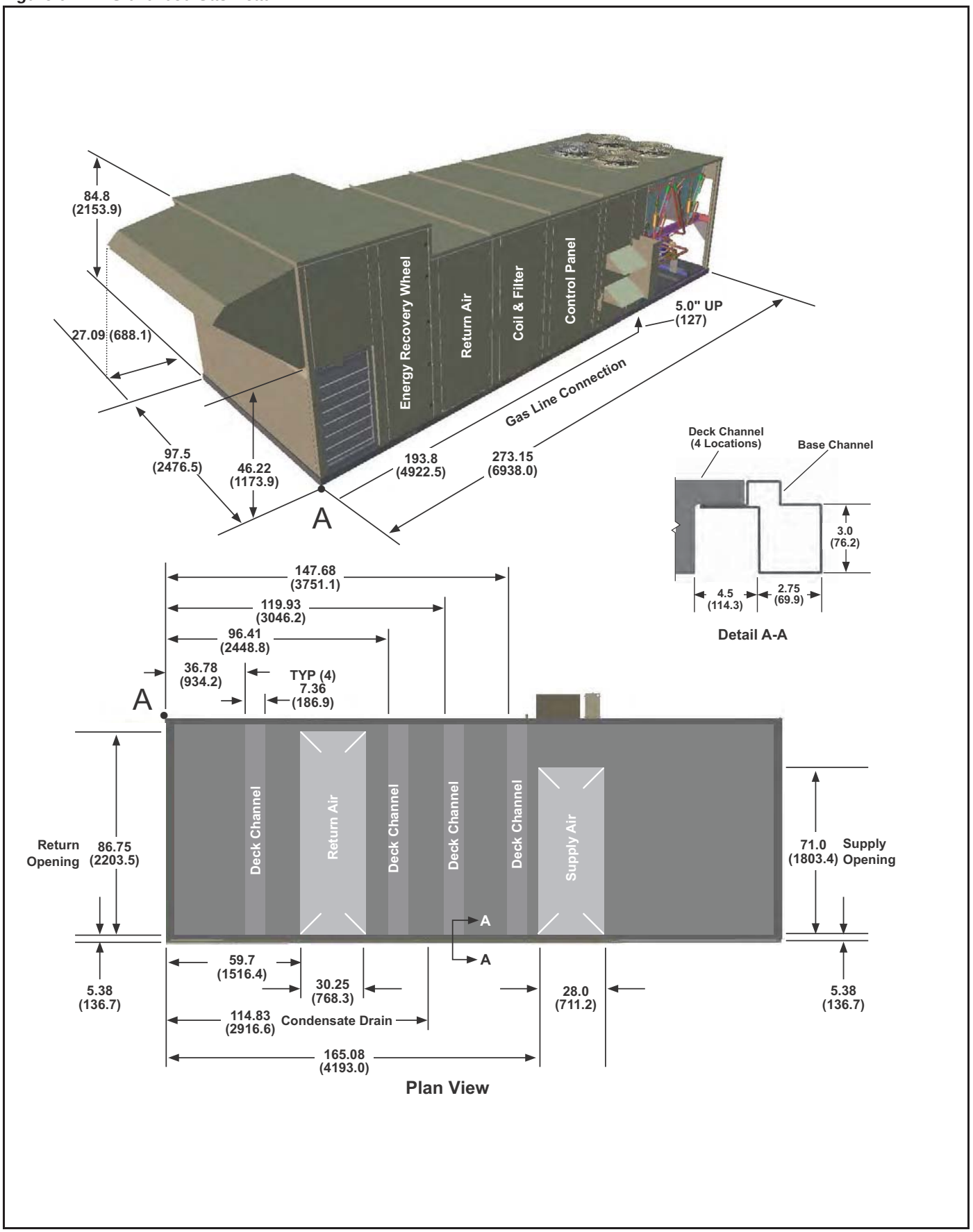
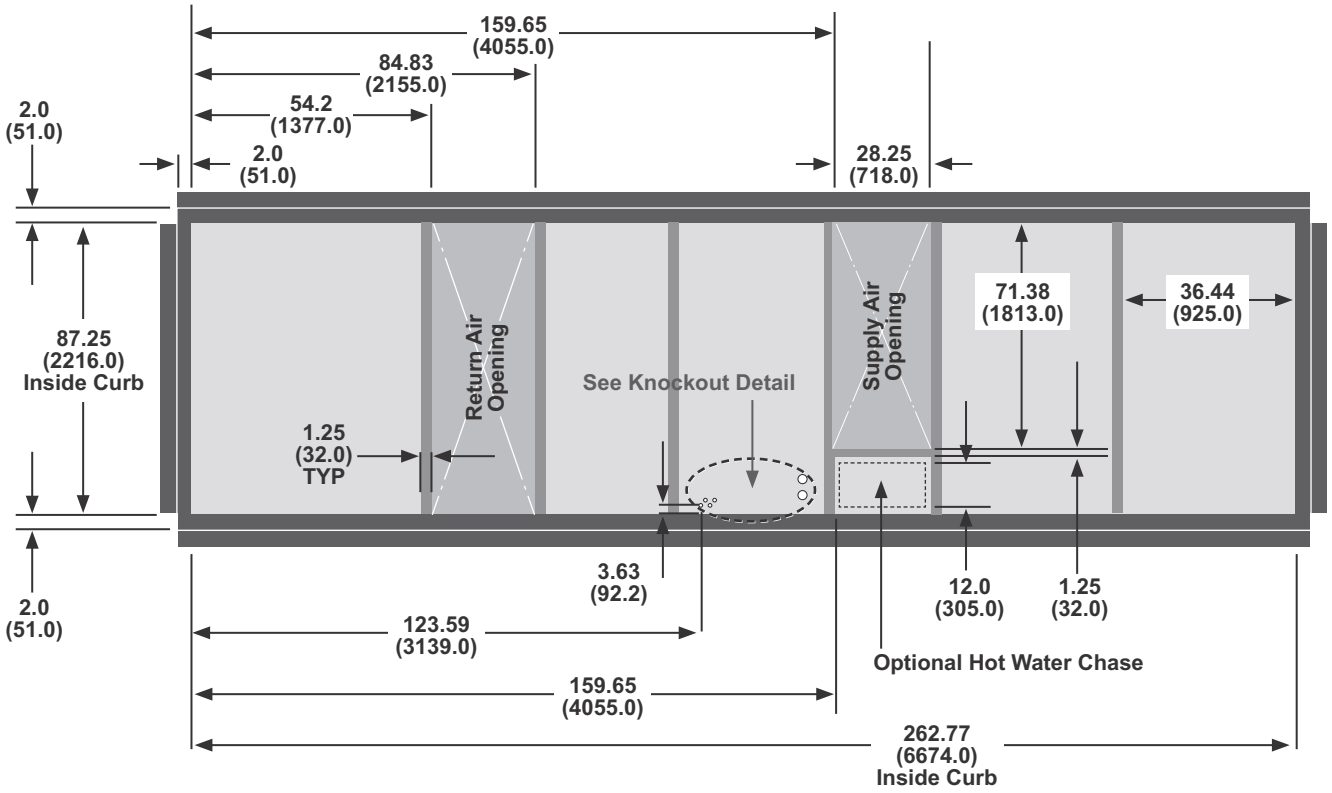


Figure 62: MPS 040–050 Gas Heat

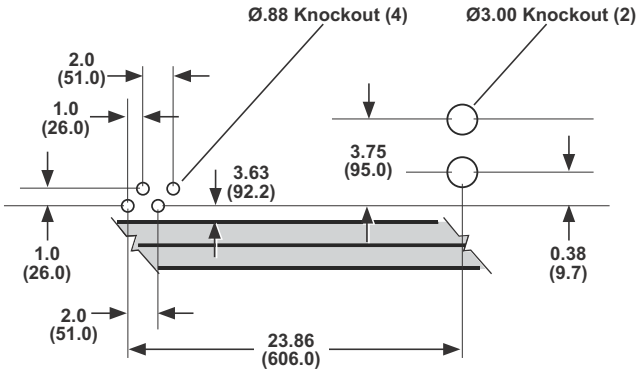


MPS 040–050 Units with Energy Recovery Wheel Roof Curb Dimensions

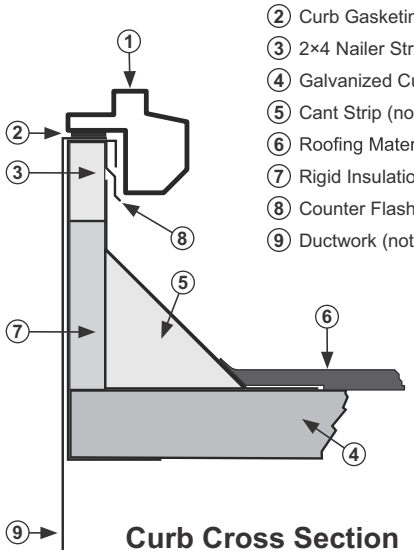
Figure 63: MPS 040–050 Roof Curb



Plan View



Knockout Detail



1. Unit Base
2. Curb Gasketing
3. 2×4 Nailer Strip
4. Galvanized Curb
5. Cant Strip (not furnished)
6. Roofing Material (not furnished)
7. Rigid Insulation (not furnished)
8. Counter Flashing (not furnished)
9. Ductwork (not furnished)

Curb Cross Section

MPS 062 Unit and Curb Dimensions

Note: Exact length varies with options (refer to MPS 062–075 Additional Curb Dimensions, page 79).

Figure 64: Longest MPS 062 Cooling/Gas or Electric Heating Unit

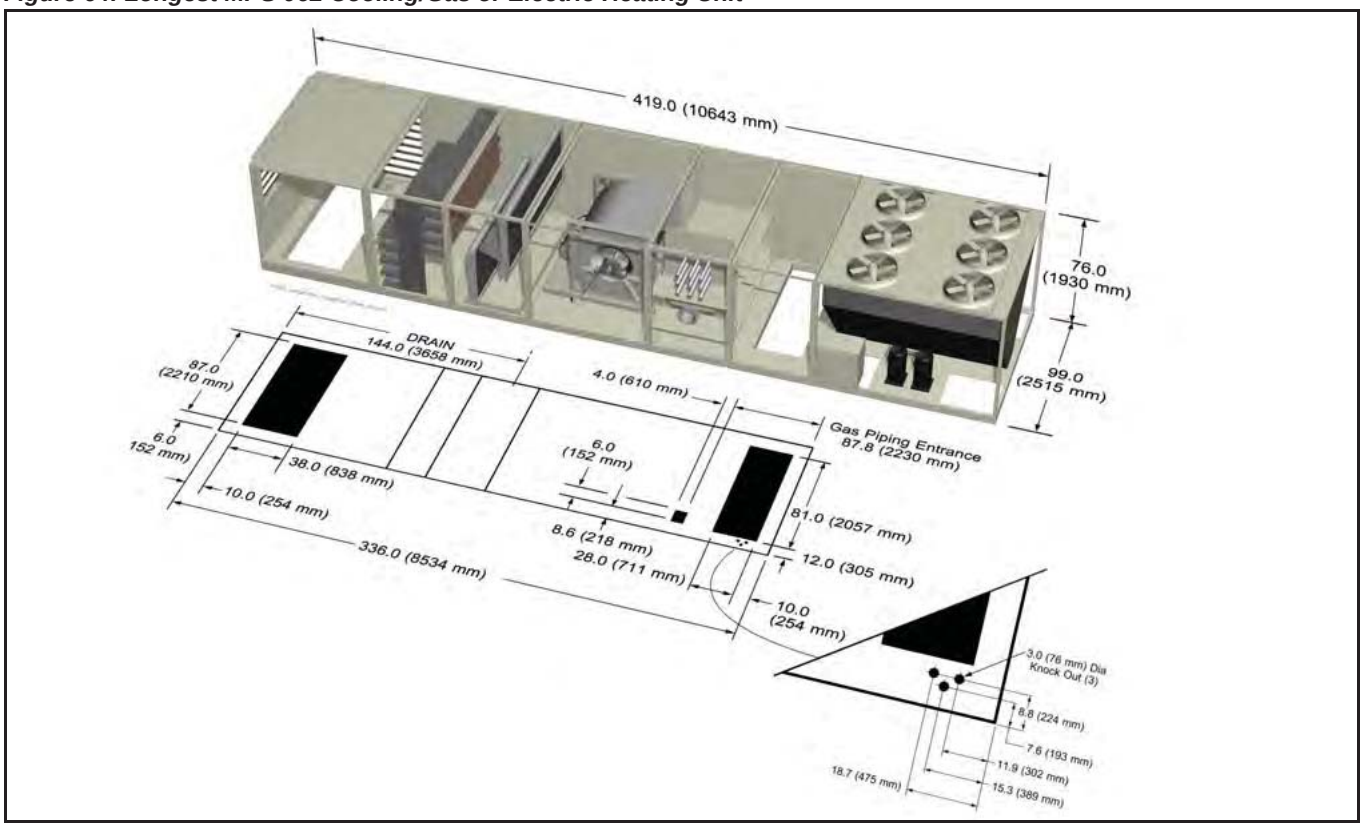
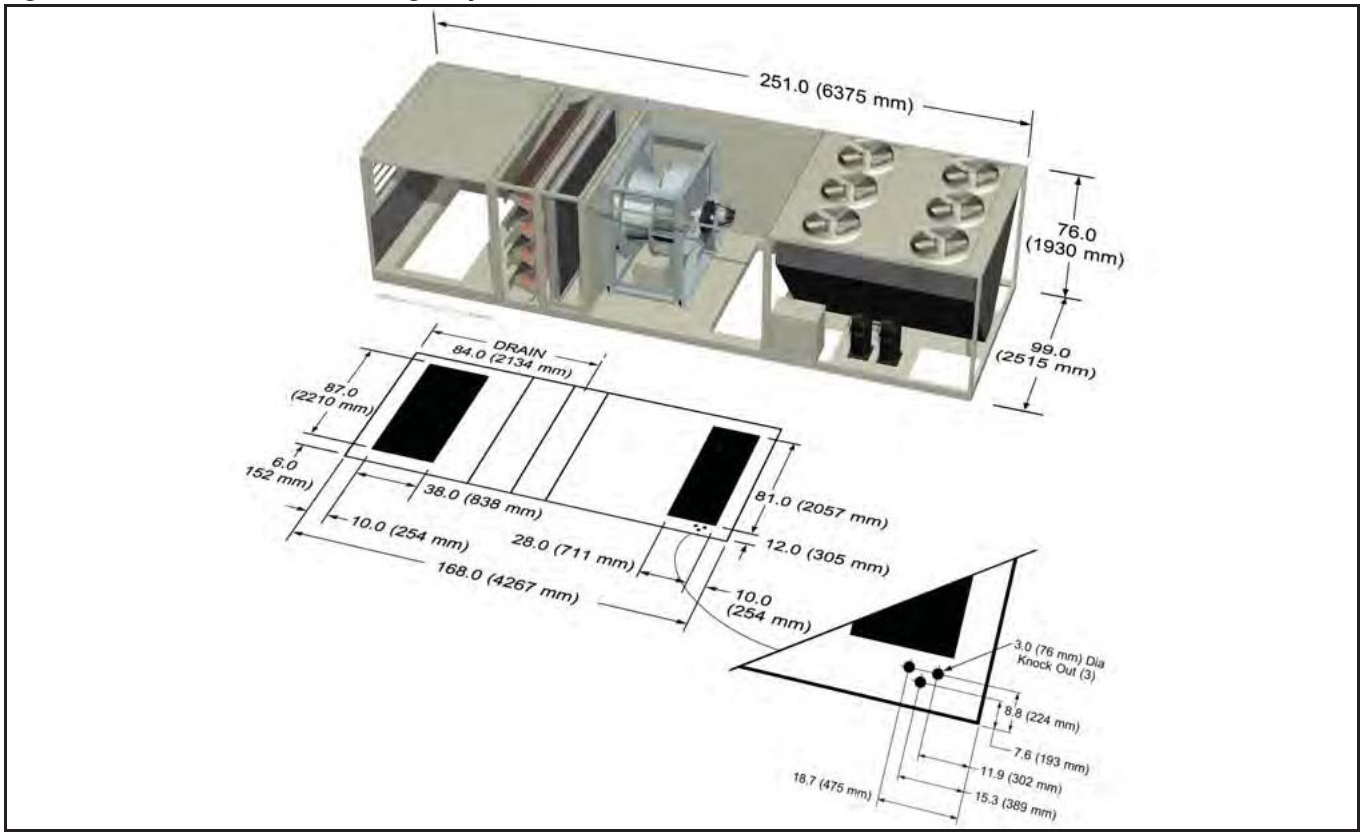


Figure 65: Shortest MPS 062 Cooling Only Unit



MPS 070–075 Unit and Curb Dimensions

Note: Exact length varies with options (refer to MPS 062–075 Additional Curb Dimensions, page 79).

Figure 66: Longest MPS 070–075 Cooling/Gas or Electric Heating Unit

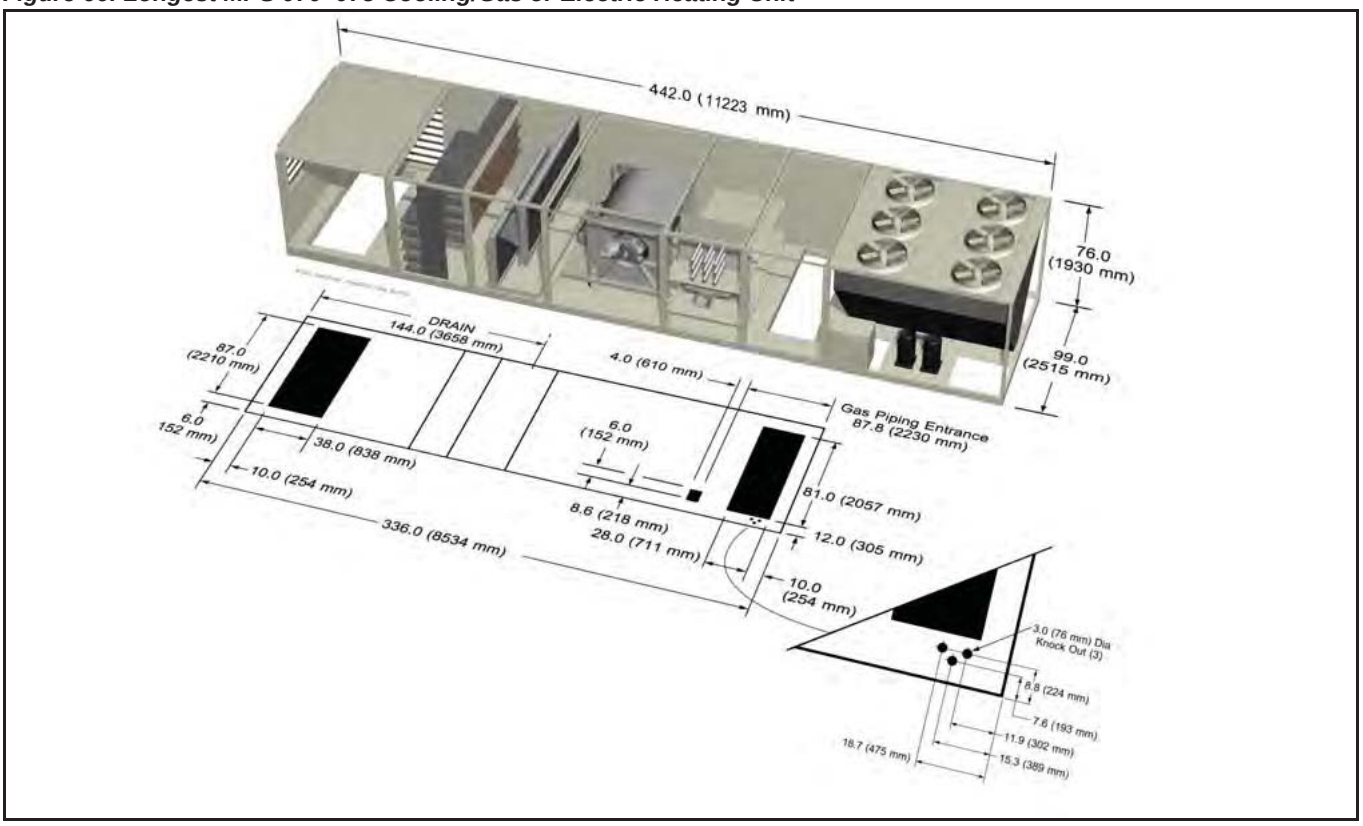
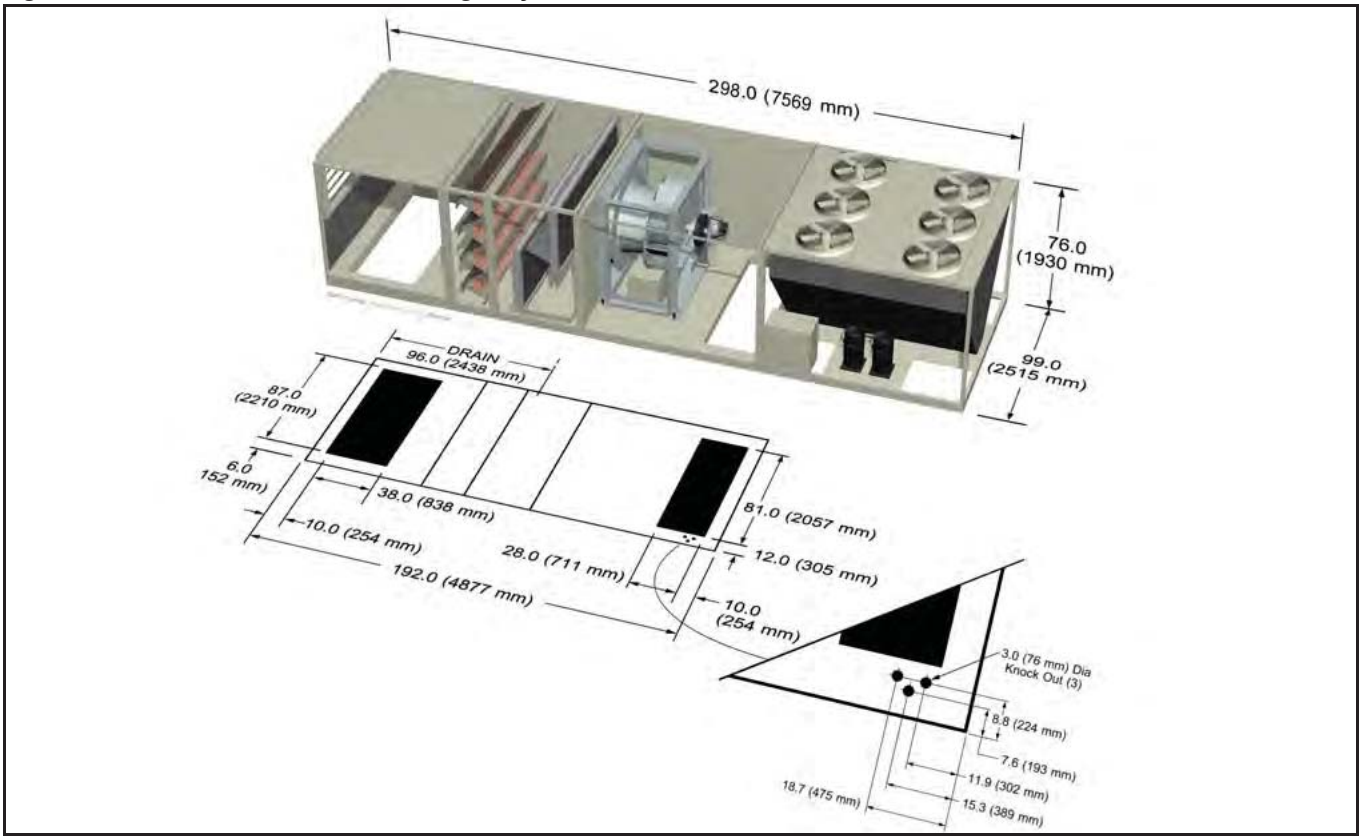


Figure 67: Shortest MPS 070–075 Cooling Only Unit



MPS 062–075 Additional Curb Dimensions

Figure 68: Curb Cross Section

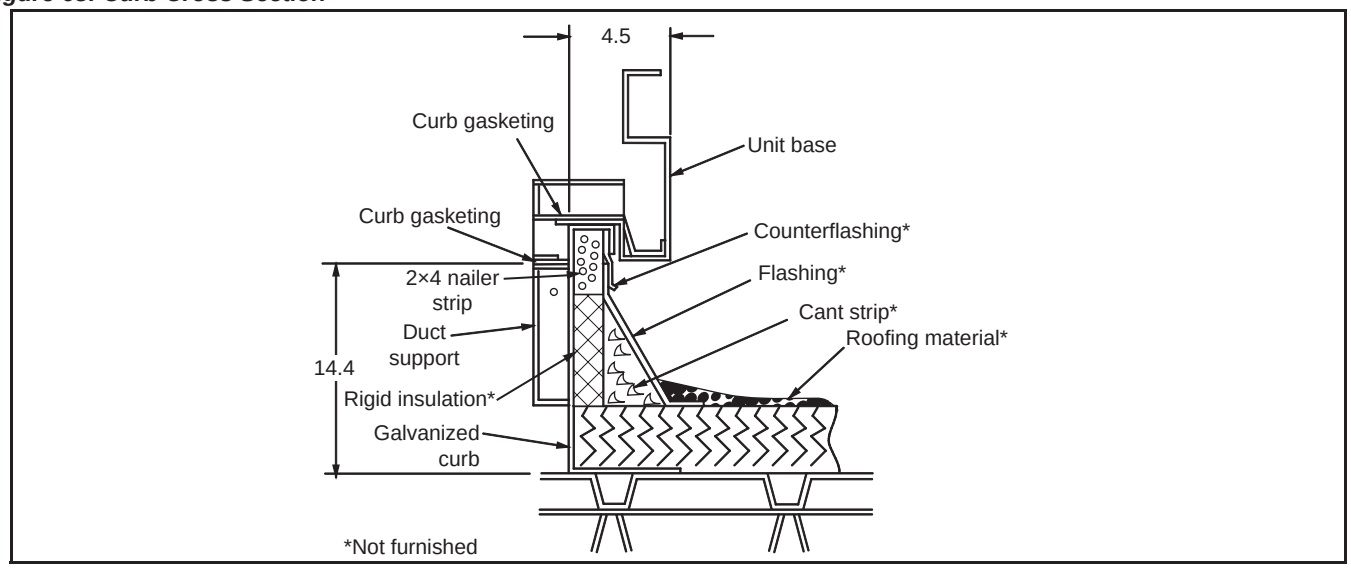


Figure 69: Curb Cross Section

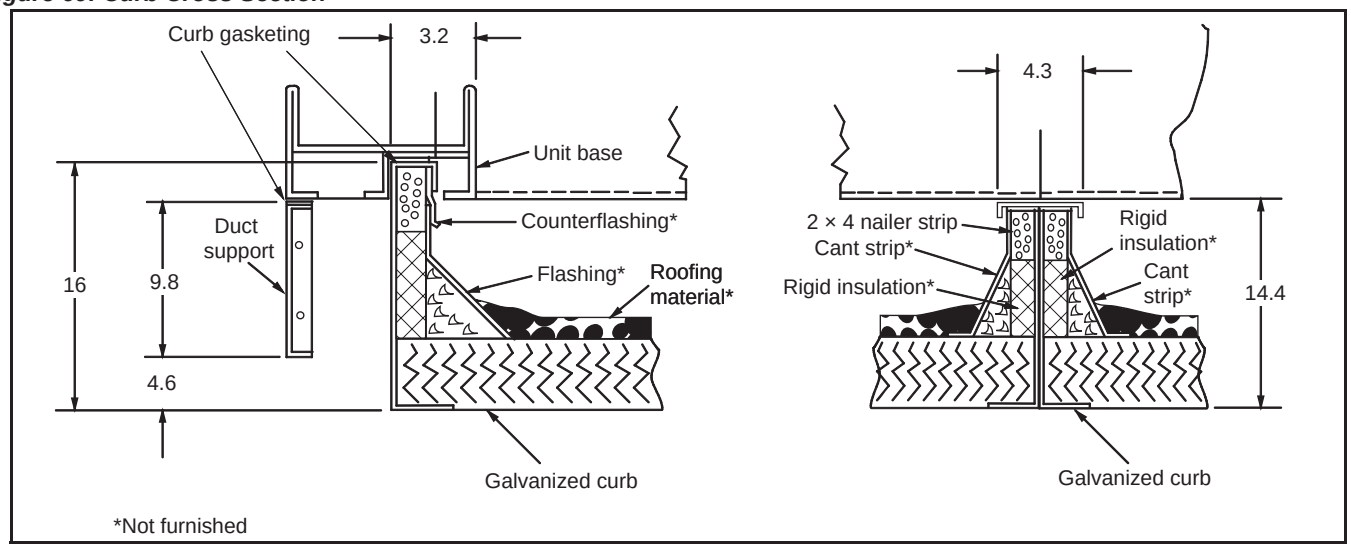
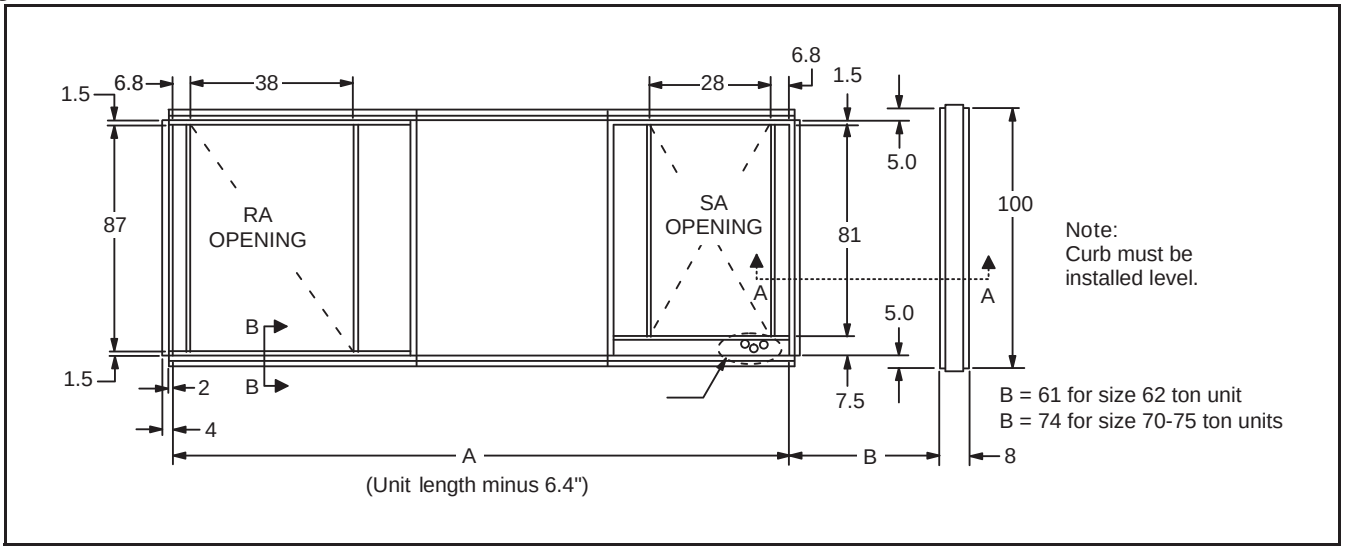


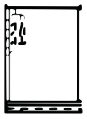
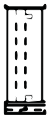
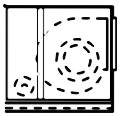
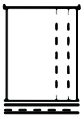
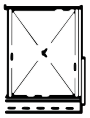
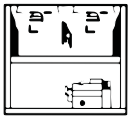
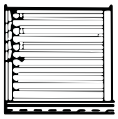
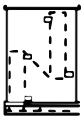
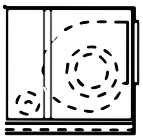
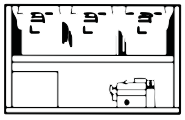
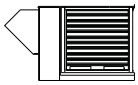
Figure 70: Roof Curb Dimensions



Dimensional Data

MPS 062–075 Section Dimensions

Figure 71: MPS 062–075 Gas or Electric Heat Section Dimensions

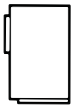
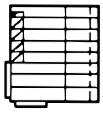
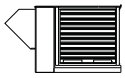
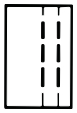
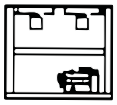
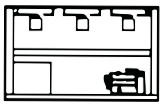
Position A Outdoor/ Return Air Mandatory	Position B Filter Mandatory	Position D DX Coil Mandatory	Position F Supply Air Fan Mandatory	Position G Heat Mandatory	Position K Discharge Plenum Mandatory	Position M Air-cooled Condensing Unit
30% Outside Air  48	Angular  24	N/A on Size 70-75 (39.5 sq. ft.)  24	30” Dia  72	Electric  48	Discharge Plenum  48	Size 62 Air-cooled Condenser  83 (Does not affect curb length)
Economizer  72	Cartridge (40 sq. ft.)  24	(47.1 sq. ft.)  48	33” Dia  96	Gas  48		Size 70-75 Air-cooled Condenser  106 (Does not affect curb length)
Econ w/ Prop. Exh. Fans, Bottom or Back Ret.  72	Cartridge (48 sq. ft.) 					

Example: MPS 062

Section description	**Length (in.)**
Bottom return economizer with exhaust air fan =	72
Angular filters =	24
Standard size cooling coil =	24
Supply fan =	72
Gas heat =	48
Discharge plenum =	48
Air cooled condensing unit =	83
Total air handler length =	288
Total unit length (including condensing unit) =	371

For a custom certified drawing of your specific requirements, consult your local McQuay sales representative.

Figure 72: MPS 062–075 Cooling Only or Hot Water Section Dimensions

Exhaust/Return Air	Filter	DX Coil	Optional Heat	Supply Air Fan	Air-Cooled Condensing Unit
30% OA  48 in. Economizer  72 in. Econ w/ Prop. Exh. Fans, Bottom or Back Ret. Fans  72	TA/30  24 in. 65/95 40 ft^2  24 in. 65/95 48 ft^2  48 in.	N/A on Size 70-75 40.1 ft^2  24 in. 47.4 ft^2  48 in.	S&HW  48 in.	44 in. Dia  72 in.	Size 62  83 in. (Does not affect curb length) Size 70-75  106 in. (Does not affect curb length)

MPS 062–075 Knockout Dimensions

Figure 73: Main Control Panel/Discharge Plenum Knockouts

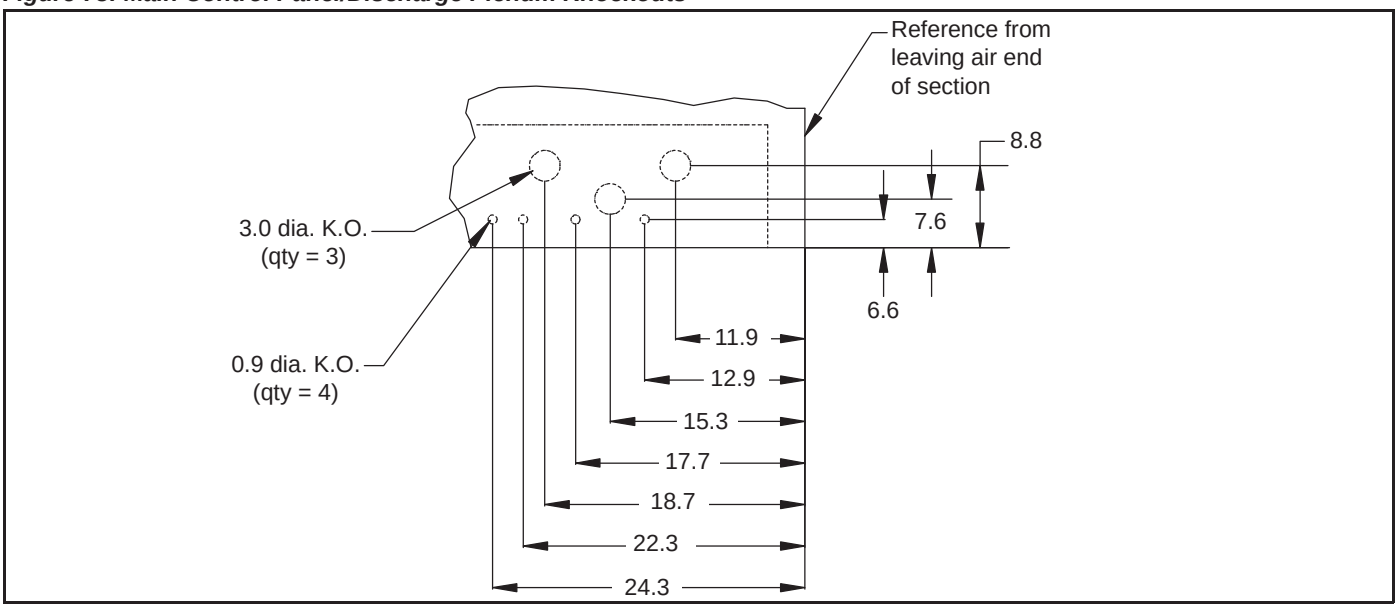


Figure 74: Main Control Panel/Discharge Plenum Knockout Detail

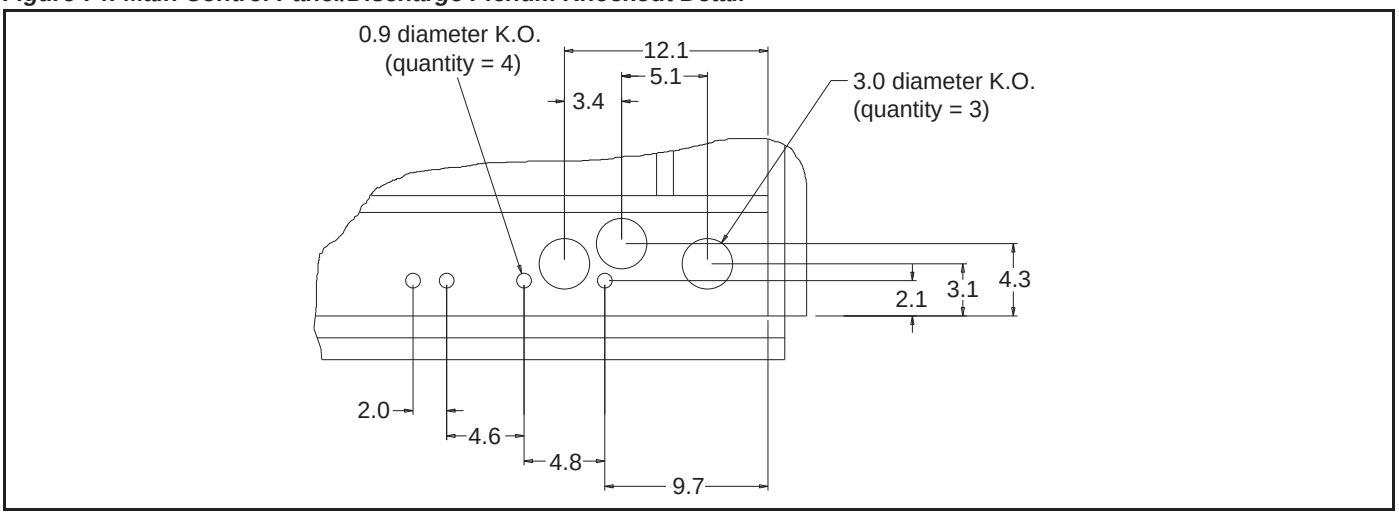
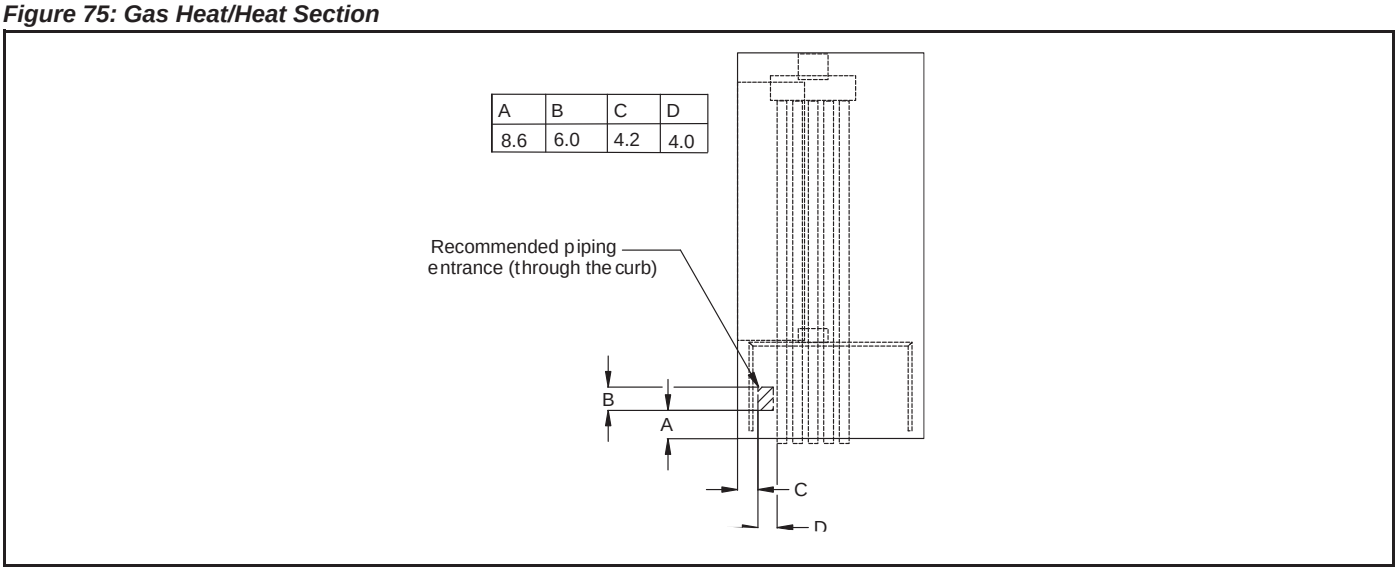


Figure 75: Gas Heat/Heat Section



MPS 015–050 Unit and Curb Weights

The following tables detail overall unit weight. Figure 76 details weight distribution percentages and loading point locations..

Table 36: Unit Base Weights

Unit (Tons)	Total Weight (lbs)
015	2655
017	2705
025	3055
030	3610
035	3660
040	4685
050	4985

Table 37: Unit Curb Weights

Unit (tons)	Curb Height (inches)	Total Weight (lbs)
Standard Unit		
015–035	14"	341
	24"	504
040–050	14"	461
	24"	706
Unit with Energy Wheel		
015–035	14"	458
	24"	674
040–050	14"	619
	24"	908

.

Table 38: Heat Section Weights

Unit (tons)	Weights (lbs)			
	High Gas Heat	Low Gas Heat	Electric Heat	Hot Water Heat
015	200	100	120	195
017	200	100	120	195
025	200	100	120	195
030	270	135	270	291
035	270	135	270	291
040	350	175	350	307
050	350	175	350	307

Table 39: Energy Recovery Section Weights

Unit	Weight (lbs.)
015–025	1200
030–035	1540
040–050	1800

Table 40: Weight Distribution Locations (see Figure 76)

Unit (Tons)	Distance		
	L1	L2	L3
015–035 Ton Unit	35.5	62.0	52.0
040–050 Ton Unit	40.0	69.0	89.0

Table 41: Curb Weights

Unit (Tons) / Curb Height	Weight (lbs)	
	without ERW	with ERW
015–035 / 14" Curb	341	458
015–035 / 24" Curb	501	674
040–050 / 14" Curb	481	619
040–050 / 24" Curb	708	908

Figure 76: Weight Distribution Locations and % of Total Load (MPS 030–035 Example)

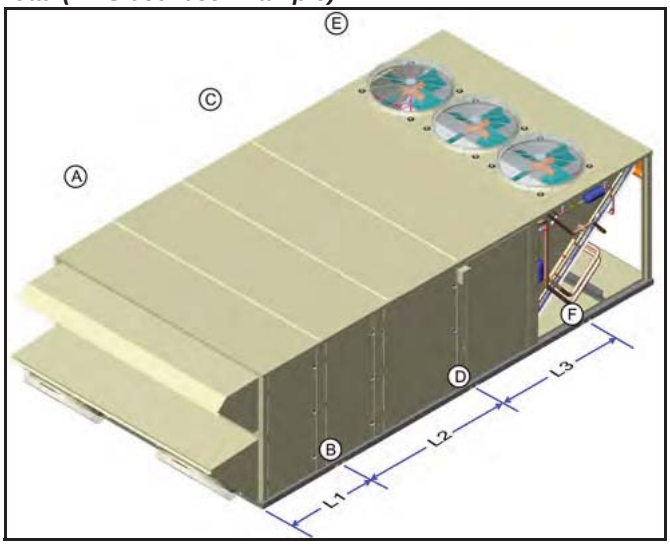
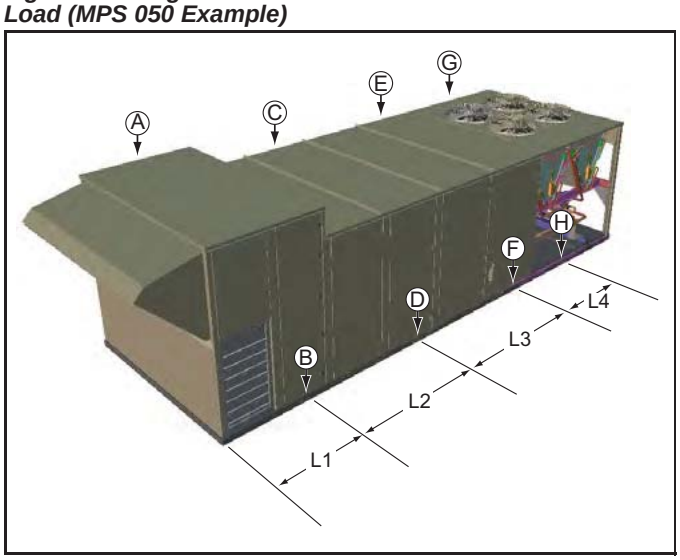


Table 42: Weight Distribution Locations (see Figure 77)

Unit (Tons)	Distance			
	L1	L2	L3	L4
040/050 Ton Unit	42.2	66.6	58.3	60.9

Figure 77: Weight Distribution Locations and % of Total Load (MPS 050 Example)



MPS 015–050 Energy Recovery Wheel Weights

The following table details unit weights for the MPS 015–050 ton units.

Table 43: Energy Wheel Weight Distribution

Unit	Point							
	Percent of total							
	A	B	C	D	E	F	G	H
015–050 without Energy Wheel	11%	11%	20%	24%	16%	18%	N/A	N/A
015–035 with Energy Wheel	13%	12%	20%	21%	17%	17%	N/A	N/A
040–050 with Energy Wheel	12%	12%	13%	13%	12%	12%	13%	13%

MPS 062–075 Unit Weights

The following table details unit weights for the MPS 062–075 ton units.

Table 44: MPS 062 to 075 (lbs.)

Components	062E	070E	075E
Unit configuration			
MPS, basic unit*	5460	5720	5895
Outdoor/return air options			
Return air plenum	Included in basic unit		
0–30% O.A. hood	222	222	222
0–100% economizer	1065	1065	1065
Filter options			
30% pleated	4	4	4
65% cartridge—standard flow	57	57	57
—Medium flow	538	538	538
95% cartridge—standard flow	67	67	67
—Medium flow	550	550	550
Supply air fan assembly			
Cooling only or hot water	1217	1217	1217
Gas or electric heat	965	965	965
Evaporator coils—aluminum fins, standard airflow face area			
5-row, 10 fpi	559	N/A	N/A
Evaporator coils—aluminum fins, high airflow face area			
5-row, 10 fpi	1224	1224	1224
Hot water coil			
1-row	373	373	373
2-row	449	449	449
Electric Heat			
100 kW low capacity electric heat	1555	1555	1555
160 kW medium capacity electric heat	1575	1575	1575
200 kW high capacity electric heat	1600	1600	1600
Gas Heat			
400 MBh low fire furnace	1630	1630	1630
640 MBh medium fire furnace	1690	1690	1690
790 MBh high fire furnace	1780	1780	1780
Exhaust air fan assembly			
1 fan, bottom or back return	525	525	525
2 fans, bottom or back return	785	785	785
Accessory items			
Variable frequency drive—SAF	150	150	150
Insulation liners			
2", 1.5 lbs., with solid liners: weight per foot of unit length	25	25	25

Note: Basic unt consists of return air plenum, angular filter section, supply air fan section without fan or motor, cooling section without coil, and condensing unit.

6-Row Coil and HGRH Coil Weights

Table 45: Coil Weights

Unit	Weight (lbs)	
	6 Row DX	HGRH
15–25	118	70
30–35	164	82
40	187	92
50	231	92

Fan Motor Weights

Table 46: Supply, Exhaust and Return Fan Motors

Motor hp	Weight (lbs)
	Totally enclosed
5	85
7.5	140
10	170
15	235
20	300
25	330
30	390
40	510

Roof Curb Weights

Calculate the weight of the unit curb using the following equations:

Weight formula

Base curb wt. (lb.) = 170 + 0.74 [170 + 2 × curb length (in.)] + additional weight (steps 1-3 below) as required

Note: Curb length does not include condenser length.

Additional Weights

1. For bottom return opening, add 91 lbs.
2. For bottom discharge opening, add 78 lbs.
3. Cross supports:
   – For curb length greater than 288 in., add 30 lbs.

Example: MPS 070E with Gas Heat

Component		Lbs.
Basic unit		5,720
Economizer		1,065
	30% efficiency filters	4
	Supply fan	965
	DX coil— high airflow	1,224
	SAF motor—40 hp	510
Liners		650
		= 10,138 lbs

Liner calculations		
Section	Economizer	6
	Filter	2
	Supply fan	6
	Heat	4
	DX coil	4
	Discharge plenum	4
	Total length of air handler (feet)	26
	× 25 lbs. per ft.	**= 650 lbs.**

Note: For structural purposes, consider roof curb weight.

Power Wiring

Table 47: Recommended Supply Data

Ampacity	No. of Power Wires per Phase			Wire Gauge			Insulation Rating (0˚C)
30	1			10			75
40	1			8			75
55	1			6			75
70	1			4			75
85	1			3			75
95	1			2			75
130	1			1			75
150	1			1/0			75
175	1			2/0			75
200	1			3/0			75
230	1			4/0			75
255	1			250			75
Ampacity	**No. of Power Wires per Phase**			**Wire Gauge**			**Insulation Rating (0˚C)**
	MPS 015–025	MPS 030–050	MPS 062–075	MPS 015–025	MPS 030–050	MPS 062–075	MPS 015–075
300	2	2	1	1/0	1/0	300	75
350	2	2	1	2/0	2/0	400	75
400	2	2	2	3/0	3/0	3/0	75
460	2	2	2	4/0	4/0	4/0	75
510	2	2	2	250	250	250	75
600	3	3	2	3/0	3/0	350	75
690	3	3	2	4/0	4/0	400	75
765	3	3	2	250	250	500	75

Table 48: SAF Data and MPS 062–075 EAF Data

HP	Voltage	Amps
5	208	15.0
5	230	13.2
5	460	6.6
5	575	5.2
7.5	208	23.0
7.5	230	19.4
7.5	460	9.7
7.5	575	8.0
10	208	26.0
10	230	25.0
10	460	13.0
10	575	10.0
15	208	37.4
15	230	35.4
15	460	17.7
15	575	14.1
20	208	49.0
20	230	47.0
20	460	24.0
20	575	19.0
25	208	63.0
25	230	60.0
25	460	31.0
25	575	24.0
30	208	74.0
30	230	70.0
30	460	35.0
30	575	28.0
40	208	11.0
40	230	96.0
40	460	48.0
40	575	38.0

Table 49: Condenser Fan Quantity Data

Unit Size	Condenser Fan Quantity
015–025	2
030–035	3
040–050	4
062–070	6
075	8

Table 50: Condenser Fan Motor Data

Voltage	Full Load Amps Per Condenser Fan Motor
208/230	4
460	2
575	1.7

Table 51: MPS 015–050 Axial Propeller Exhaust Fan Data (MPS 062–075 use 1 or 2 5hp Motors - see Figure 48)

Size	Voltage	HP	Amps	Qty.	Total (Amps)
15	208	1	4.2	1	4.2
	230	1	4.0	1	4.0
	460	1	2.0	1	2.0
	575	1	1.7	1	1.7
17	208	1	4.2	1	4.2
	230	1	4.0	1	4.0
	460	1	2.0	1	2.0
	575	1	1.7	1	1.7
25	208	1	4.2	2	8.4
	230	1	4.0	2	8.0
	460	1	2.0	2	4.0
	575	1	1.7	2	3.4
30	208	1	4.2	2	8.4
	230	1	4.0	2	8.0
	460	1	2.0	2	4.0
	575	1	1.7	2	3.4
35	208	1	4.2	2	8.4
	230	1	4.0	2	8.0
	460	1	2.0	2	4.0
	575	1	1.7	2	3.4
40	208	1	4.2	3	12.6
	230	1	4.0	3	12.0
	460	1	2.0	3	6.0
	575	1	1.7	3	5.1
50	208	1	4.2	3	12.6
	230	1	4.0	3	12.0
	460	1	2.0	3	6.0
	575	1	1.7	3	5.1

Table 52: Energy Recovery Exhaust Fan

Cabinet	Application	Size (in [mm])	Motor HP	Quantity
15	Economizer	18 [457.2]	4.0	1
	30% OA	18 [457.2]	4.0	1
	100% OA	18 [457.2]	4.0	1
17	Economizer	22 [558.8]	8.0	1
	30% OA	18 [457.2]	4.0	1
	100% OA	18 [457.2]	4.0	1
25	Economizer	22 [558.8]	8.0	1
	30% OA	18 [457.2]	4.0	1
	100% OA	22 [558.8]	8.0	1
30	Economizer	18 [457.2]	4.0	2
	30% OA	18 [457.2]	4.0	1
	100% OA	22 [558.8]	8.0	1
35	Economizer	22 [558.8]	8.0	2
	30% OA	22 [558.8]	8.0	1
	100% OA	22 [558.8]	8.0	1
40	Economizer	22 [558.8]	8.0	2
	30% OA	22 [558.8]	8.0	1
	100% OA	18 [457.2]	4.0	2
50	Economizer	22 [558.8]	8.0	2
	30% OA	22 [558.8]	8.0	1
	100% OA	22 [558.8]	8.0	2

Table 53: Energy Recovery Exhaust Fan Amps

Cabinet	Application	Voltage	Amps	Quanity	Total Amps
15/17	All	208/230	8.8	1	8.8
		460	4.0	1	4.0
		575	4.0	1	4.0
25	Economiuzer	208/230	13.5	1	13.5
		460	6.1	1	6.1
		575	6.1	1	6.1
25	100% & 0-30% OA	208/230	8.8	1	8.8
		460	4.0	1	4.0
		575	4.0	1	4.0
30/35	Economizer	208/230	13.5	2	27.0
		460	6.1	1	6.1
		575	6.1	1	6.1
30/35	0-30% OA	208/230	8.8	1	8.8
		460	4.0	1	4.0
		575	4.0	1	4.0
30/35	100% OA	208/230	13.5	1	13.5
		460	6.1	1	6.1
		575	6.1	1	6.1
40	Economizer	208/230	13.5	2	27.0
		460	6.1	2	12.2
		575	6.1	2	12.2
	0-30% OA	208/230	13.5	1	13.5
		460	6.1	1	6.1
		575	6.1	1	6.1
	100% OA	208/230	8.8	1	8.8
		460	4.0	1	4.0
		575	4.0	1	4.0
50	Economizer & 100% OA	208/230	13.5	2	27.0
		460	6.1	2	12.2
		575	6.1	2	12.2
	0-30% OA	208/230	13.5	1	13.5
		460	6.1	1	6.1
		575	6.1	1	6.1

Table 54: Rated Load Amps Per Compressor—MPS 015–050

Size	Voltage	Comp #1	Comp #2	Comp #3	Comp #4
15	208/230	25.0	23.1	-	-
	460	12.2	12.2	-	-
	575	9.3	8.7	-	-
17	208/230	25.0	27.6	-	-
	460	12.2	13.1	-	-
	575	9.3	11.5	-	-
25	208/230	23.1	39.1	23.1	-
	460	12.2	18.6	12.2	-
	575	8.7	15.4	8.7	-
30	208/230	39.1	27.6	27.6	-
	460	18.6	13.1	13.1	-
	575	15.4	11.5	11.5	-
35	208/230	39.1	39.1	27.6	-
	460	18.6	18.6	13.1	-
	575	15.4	15.4	11.5	-
40	208/230	39.1	39.1	27.6	27.6
	460	18.6	18.6	13.1	13.1
	575	15.4	15.4	11.5	11.5
50	208/230	39.1	39.1	39.1	39.1
	460	18.6	18.6	18.6	18.6
	575	15.4	15.4	15.4	15.4

Supply Power Wiring Data

Table 55: Rated Load Amps—MPS 062–075

Model	Voltage	Circuit 1		Circuit 2	
		RLA / comp	Comp Qty	RLA / comp	Comp Qty
062	208-60-3	56.7	2	56.7	2
	230-60-3	51.3	2	51.3	2
	460-60-3	23.1	2	23.1	2
	575-60-3	19.9	2	19.9	2
070	208-60-3	36.8	3	36.8	3
	230-60-3	33.3	3	33.3	3
	460-60-3	17.9	3	17.9	3
	575-60-3	12.8	3	12.8	3
75	208-60-3	53.2	3	53.2	3
	230-60-3	48.1	3	48.1	3
	460-60-3	18.6	3	18.6	3
	575-60-3	14.7	3	14.7	3

Electric Heater Data

Table 56: MPS 020–050 Electric Heater Data

kW	Voltage	Amps
18	208	50
18	230	45
18	460	23
18	575	18
36	208	100
36	230	90
36	460	45
36	575	36
54	208	150
54	230	130
54	460	65
54	575	52
72	208	200
72	230	173
72	460	86
72	575	70
90	208	250
90	230	217
90	460	108
90	575	87
108	460	130
108	575	104

Table 57: MPS 062–075 Electric Heat Data

Model	208/60/3			240/60/3			480/60/3			600/60/3		
	kW	FLA	Stages	kW	FLA	Stages	kW	FLA	Stages	kW	FLA	Stages
100	74.7	207.4	4	99.5	239.4	4	99.5	119.7	4	99.5	95.7	4
160	119.7	332.0	4	159.2	383.0	4	159.2	191.5	4	159.2	153.2	4
200	-	-	-	-	-	-	199.0	239.4	4	199.0	191.5	4

The following formulas can be used to calculate Minimum circuit Ampacity (MCA) and Maximum Rated Overcurrent Protection Device (MROPD).

Cooling Only/Cooling with Gas Heat/Hot Water Heat

MCA = 1.25 x current draw of largest motor/compressor + current draw of the rest of the motors/compressors + 1 (controls).

MROPD = 2.25 x current draw of largest motor/compressor + current draw of the rest of motors/compressors + 1 (controls).

Elect. Heat (sizes 15–70 and size 75 with 160–200 kW)

MCA = 1.25 x (supply fan motor amps + exhaust fan motor amps + transformer) + electric heat load.

MROPD = 2.25 (largest fan motor) + electric heat load + remaining fan motor + transformer.

Electric Heat (Size 75, 100 kW)

MCA = 1.25 x current draw of largest motor/compressor + current draw of the rest of the motors/compressors + 1 (controls).

MROPD = 2.25 x current draw of largest motor/compressor + current draw of the rest of motors/compressors + 1 (controls).

Part 1: General

1.01 Section Includes:

A Packaged rooftop air conditioners.

1.02 References

A AFBMA 9-Load Ratings and Fatigue Life for Ball Bearings.

B AMCA 99-Standards Handbook.

C AMCA 210-Laboratory Methods of Testing Fans for Rating Purposes.

D AMCA 300-Test Code for Sound Rating Air Moving Devices.

E AMCA 500-Test Methods for Louver, Dampers, and Shutters.

F ARI 410-Forced-Circulation Air-Cooling and Air-Heating Coils.

G ARI 430-Central-Station Air-Handling Units.

H ARI 435-Application of Central-Station Air-Handling Units.

I IBC 2000 - International Building Code.

J NEMA MG1-Motors and Generators.

K National Electrical Code.

L NFPA 70-National Fire Protection Agency.

M SMACNA-HVAC Duct Construction Standards-Metal and Flexible.

N UL 900-Test Performance of Air Filter Units.

1.03 SUBMITTALS

A Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.

B Product Data:

1 Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.

2 Provide computer generated fan curves with specified operating point clearly plotted.

3 Manufacturer's installation instructions.

1.04 Operation And Maintainence Data

A Maintenance Data: Provide instructions for installation, maintenance and service.

1.05 Qualifications

A Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B Startup must be done by trained personnel experienced with rooftop equipment.

C Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 Delivery, Storage, And Handling

A Deliver, store, protect and handle products to site.

B Accept products on site and inspect for damage.

C Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

Part 2: Products

2.01 Manufacturers

A Basis of Design: McQuay International

1 McQuay.

2 Trane.

3 Carrier.

4 York.

5 AAON.

2.02 General Description

A Furnish as shown on plans, McQuay Maverick Singlezone Heating and Cooling Unit(s) model MPS. Unit performance and electrical characteristics shall be per the job schedule.

B Configuration: Fabricate as detailed on prints and drawings:

1 Return plenum/economizer section.

2 Filter section.

3 Cooling coil section.

4 Supply fan section.

5 Gas heating section.

6 Electric heating section.

7 Hot water heating section.

8 Condensing unit section.

C The complete unit shall be cETLus/MEA listed.

D The burner and gas train for the unit furnace shall be cETLus approved.

E Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. MPS packaged units shall be shipped fully charged with Refrigerant 410A and oil.

F The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 Cabinet, Casing, And Frame

A Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of [4.0 on MPS 015–050 ton units] [6.5 on MPS 062–075 ton units], and shall be neoprene coated glass fiber. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to [5.0 on sizes 020–050] [6.5 on sizes 062–075] inches w.g.

B Double wall construction shall be the minimum design in all sections down stream of the cooling coil section. This shall include the fan, gas heat, and discharge plenum sections as a minimum.

C Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished panel surfaces to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

D Service doors shall be provided on both sides of the fan section, coil section, economizer section, control panel, and the filter section in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

E The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 Supply Fan

A Supply fan shall be a [SWSI airfoil centrifugal fan] [DWDI on sizes 062–075 with gas or electric heat]. The fan blade design shall be a double blade with the airfoil geometry, a backward inclined blade fan wheel design will not be acceptable. The fan wheel shall be Class II construction with aluminum fan blades welded to the back plate and end rim. The supply fan shall be mounted using solid-steel shafts and wheel hubs with mating keyways.

B The fan assembly shall have fixed pitched drives with a minimum of two belts. The drives shall be selected with a minimum diameter of 4 inches and a 1.2 service factor. The belts shall be of the grip-notch design.

C All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Heavy-duty concentric locking pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide a L-50 life at 250,000 hours. The entire fan assembly shall be isolated from the fan bulkhead and mounted on spring isolators [1" on sizes 015–050] [2" on sizes 062–075].

D Fan motors shall be heavy-duty 1800 rpm open drip-proof (ODP) type with grease lubricated ball bearings. Motors shall be premium efficiency. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment. Motors shall be suitable for use with a variable frequency drive.

E The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.05 Exhaust Fan

A Exhaust fans shall be provided. Blades shall be constructed with fabricated steel and shall be securely attached to fan shafts. All exhaust fan assemblies shall be statically and dynamically balanced. Motors shall be permanently lubricated, heavy-duty type, carefully matched to the fan load. Ground and polished steel fan shafts shall be mounted in permanently lubricated and sealed ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds.

B The unit DDC controller shall provide building static pressure control. A factory mounted exhaust fan variable frequency drive shall provide proportional control of the exhaust fans from 25% to 80% of the supply air fan designed airflow. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.06 Variable Air Volume Control

A An electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

B The unit manufacturer shall install all power and control wiring.

C The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.07 Electrical

A Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

C A GFI receptacle shall be unit mounted. The receptacle will require a field power connection independent from the unit's main power block and/or disconnect.

D A GFI receptacle shall be unit mounted. The receptacle shall be powered by a factory installed and wired 120 V, 20 amp power supply. The power supply shall be wired to the line side of the unit's main disconnect, so the receptacle is powered when the main unit disconnect is off. This option shall include a GFI receptacle, transformer, and a branch circuit disconnect. The electrical circuit shall be complete with primary and secondary overload protection.

2.08 Cooling Section

A The cooling coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant sloped drain pan.

B Direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 4 rows and a maximum of 12 fins per inch. All units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C [Optional] Direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 6 rows for maximum dehumidification effect. All units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

D A stainless steel positively sloped drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1 The drain pan shall be connected to a threaded drain connection extending through the unit base.

2.09 Staged Gas Heating Section

A The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one or more natural gas fired heating modules factory installed downstream of the supply air fan in the heat section. Each module shall have two stages of heating control. The heating module shall be a tubular design with in-shot gas burners. The heat exchanger tubes shall be constructed of 20 ga, G160, aluminized steel. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

B Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

C The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

D The heating modules shall have a field installed kit for conversion of the unit to LP gas.

2.10 Modulating Gas Heating Section

A [015–050 Low Capacity] The rooftop unit shall include a natural gas heating section. The gas furnace design shall have a natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The module shall be complete with furnace controller and control valve capable of modulating operation from 100% down to 28% of full fire capacity. The heating module shall be a tubular design with in-shot gas burners. The heat exchanger tubes shall be constructed of stainless steel. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

B [015–050 High Capacity] The rooftop unit shall include a natural gas heating section. The section design shall be two natural gas fired heating modules factory installed downstream of the supply air fan in the heat section. One module shall have two stages of capacity control. The other module shall be complete with furnace controller and control valve capable of modulating operation from 100% down to 14% of the unit's total full fire capacity. The heating modules shall be a tubular design with in-shot gas burners. The heat exchanger tubes shall be constructed of stainless steel. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

C Each 015–050 size burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

D Each 062–075 natural gas fired furnace shall be installed in the unit heat section. The heat exchanger shall include a type 321 stainless steel cylindrical primary combustion chamber, a type 321 stainless steel header, type 321 stainless steel secondary tubes and type 321 stainless steel turbulators. The heat exchanger shall have a condensate drain. Clean out of the primary heat exchanger and secondary tubes shall be accomplished without removing casing panels or passing soot through the supply air passages. The furnace section shall be positioned downstream of the supply air fan to maintain positive pressure around the heat exchanger.

The furnace will be supplied with a modulating forced draft burner. The burner shall be controlled for low fire start. The burner shall be capable of continuous modulation between 33% and100% of rated capacity and shall operate efficiently at all firing rates.

The burner shall be specifically designed to burn natural gas and shall include a microprocessor based flame safeguard control, combustion air proving switch, pre-purge timer and spark ignition. The gas train shall include redundant gas valves, maximum 0.5psi pressure regulator, shutoff cock, pilot gas valve, pilot pressure regulator, and pilot cock. The burner shall be rated for operation and full modulation capability at inlet gas pressures down to 7.5 W.C.

E The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.11 Electric Heating Section

A Heating coils shall be constructed of a low watt density, high nickel chromium alloy resistance wire, mechanically stacked and heli-arc welded to corrosion resistant terminals. A corrosion resistant heavy gauge rack shall support the elements. Safety controls shall include automatic reset high limit control with manual reset backup line break protection. Heating element branch circuits shall be fused to maximum of 48 Amps per NEC requirements.

B The electric heat section shall be positioned downstream of the supply air fan.

C Proof of airflow must be established any time the electric heat element is energized.

D The electric heat elements shall be controlled by the factory installed main unit DDC control system. The control system will have four distinct stages of heating on any unit over 25 tons. Each stage control contactor shall be a three pole contactor. When the stage control contactor is not energized, it must break all three phases of power input to the electric heater.

E The electrical power supply for the electric heater shall be from the rooftop unit control panel. Unit shall have a single point power supply connection. Independent supply power connection to the electric heater will not be accepted.

F All disconnects must be three pole to remove power from all incoming legs.

2.12 Hot Water Heating Section

A A [1] [2] row hot water heating coil shall be factory installed in the unit heat section. Coils shall be fabricated of seamless 5/8" diameter copper tubing that is mechanically expanded into high efficiency rippled and corrugated aluminum plate fins. All coil vents and drains shall be factory installed. The hot water heat section shall be installed downstream of the supply air fan. A factory-tested diffuser shall be used in order to provide air distribution across the coil.

B Hot water coil shall be fully cased to allow for easy replacement.

C Factory shall provide a field piping vestibule. The control valve shall be field supplied and installed in the unit heater vestibule. The control valve shall be capable of receiving a 2 - 10 VDC signal. Connection holes through the base of the unit in the field piping vestibule shall be cut and sealed by the field.

D All coil connections shall be copper, steel connections shall not be allowed in order to prevent dielectrics and corrosion.

E Fluid pressure drop shall conform to the mechanical schedule.

F Freeze protection by the DDC controller and use the discharge air sensor. DDC controller shall be capable of sending an alarm signal.

G Coil shall be factory leak tested with high pressure air under water.

2.13 Modulating Hot Gas Reheat Coil Section

A Unit shall be equipped with a hot gas reheat coil with hot gas coming form the unit condenser.

B The hot gas reheat option shall have a fully modulated control to allow for unit leaving air temperature control to +/- 2°.

C The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling and reheat leaving air temperature setpoints shall be adjustable through the unit MT III controller.

D Hot gas coil shall be an all aluminum design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory leak tested with high-pressure air under water.

E Hot gas coil shall be sized to allow for full condensing across the operation range of the unit. High temperature liquid shall be piped downstream of the unit's condenser coils into the liquid line.

F The refrigeration circuit shall not require receivers. The hot gas coil shall be used for refrigerant storage when the unit is not operation in a dehumidification or reheat mode.

Hot Gas Reheat Coil Section

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D The refrigeration circuit shall not require receivers. The hot gas coil shall be used for refrigerant storage when the unit is not operation in a dehumidification or reheat mode.

2.14 Filters

Draw-Through Filters

A Sizes 020–050 shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" prefilter and a 4" final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2" construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

B Size 062–075 ton units shall be provided with a draw-through filter section. The filter section shall be supplied complete with the filter rack as an integral part of the unit. The draw-through filter section shall be provided with [panel] [cartridge] filters.

C Panel filters on size 062–075 units shall be 2" thick AmericanAirFilter 30% efficient pleated panel filters. Filters shall be frame mounted and shall slide into galvanized steel racks contained within the unit. Filters shall be installed in an angular arrangement to maximize filter area and minimize filter face velocity. Filters shall be accessible from both sides of the filter section.

D Cartridge filters on size 062–075 ton units shall have [12" deep [60–65%] [90–95%] efficient, UL Std. 900, Class 1, AmericanAirFilter cartridge filters. 2" panel, 30% efficient pre-filters shall be included. Cartridge filters shall consist of filter media permanently attached to a metal frame and shall slide into a gasketed, extruded aluminum rack contained within the unit. The filter rack shall have secondary gasketed, hinged end panels to insure proper sealing. Filters shall be accessible from both sides of the filter section.

2.15 Outdoor/Return Air Section

A Sizes 015–050 shall be provided with an outdoor air economizer section. The 0 to 100% outside air economizer section shall include outdoor, return, and exhaust air dampers. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 4 cfm / square foot of damper area at 1" differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested in accordance with AMCA Standard 500.

B Sizes 062–075 shall be provided with an outdoor air economizer section. The 0 to 100% outside air economizer section shall include outdoor, return, and exhaust air dampers. Outdoor air shall enter from both sides of the economizer section through horizontal, louvered intake panels complete with rain lip and bird screen. The floor of the outdoor air intakes shall provide for water drainage. The economizer section shall allow return air to enter from the [bottom] [back] of the unit.

The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed sets of parallel blades, arranged vertically to converge the return air and outdoor air streams in multiple, circular mixing patterns. McQuay UltraSeal™ low leak dampers shall be provided. Damper blades shall be fully gasketed and side sealed. Damper leakage shall be less than 0.2% at 1.5 inches static pressure differential. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers.

C A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

D Control of the OA/RA dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. An adjustable dry bulb control shall be provided to sense the dry-bulb temperature of the outdoor air stream to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

E A return air plenum shall be provided with a 0 to 30% outdoor air hood. The hood shall allow outdoor air to enter at the back of the return air plenum. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The return air plenum shall allow return air to enter from the bottom of the unit. The outdoor air damper shall be controlled by a factory installed direct coupled actuator. The unit controller shall control the actuator to an outdoor air position setpoint that is adjustable from 0 to 30%. Upon unit shut down during unoccupied periods the outdoor air damper shall be power driven closed.

2.16 100% Outdoor Section

A Unit shall be equipped with a low leak OA damper. OA shall enter the unit through the end of the unit and shall have hoods sized to prevent water carry over during inclement weather. Damper shall be controlled with a modulating, direct coupled actuator to allow for field adjustment of unit airflow.

B Damper blades shall be gasketed with side seals to provide an air leakage rate of no more than 4 cfm / square foot of damper area at 1" differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers.

2.17 Condensing Section

A Condenser coils shall be an all aluminum design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory leak tested with high-pressure air under water. Condenser coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating.

B Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm shall be 1140 rpm maximum. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.

C Each circuit shall have fan cycling of at least one condenser fan to maintain positive head pressure. An ambient thermostat shall prevent the refrigeration system from operating below [20ºF on sizes 015–050] [45ºF on sizes 062–075.

D Condenser coils shall be protected from hail damage as an integral part of the unit design. Hail guards shall be provided on all units with vertical mounted condenser coils.

E Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.

F Each unit shall have two independent refrigeration circuits. Each circuit shall be complete with a low pressure control, filter-drier, liquid moisture indicator/sight-glass, thermal expansion valve, and a manual reset high pressure safety switch. The thermal expansion valve shall be capable of modulation from 100% to 25% of its rated capacity. Sight-glasses shall be accessible for viewing without disrupting unit operation. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

2.18 Roof Curb

A A prefabricated 14-gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment.

B The size 015–050 roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section.

C The size 062–075 roof curb shall provide complete perimeter support of the air handling section and rail support of the condensing section. Supply and return opening duct frames shall be provided as part of the curb structure allowing duct connections to be made directly to the curb prior to unit arrival.

D The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

2.19 Controls

A Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, optimal start, and fan operation.

D All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

E The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

G If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:

1 Zone sensor with tenant override switch.

2 Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only).

H The display shall provide the following information as required by selected unit options:

1 Unit status showing stages or % capacity for cooling, heating, and economizer operation.

2 Supply, return, outdoor, and space air temperature.

3 Duct and building static pressure; the control contractor is responsible for providing and installing sensing tubes.

4 Supply fan and return fan status and airflow verification.

5 Supply and return VFD speed.

6 Outside air damper position and economizer mode.

7 Cooling and heating changeover status.

8 Occupied and unoccupied.

9 Date and time schedules.

10 Up to 10 current alarms and 25 previous alarms with time and date.

11 Dirty filter status.

12 Morning warm-up or night setback status.

13 System operating hours of the SAF, EAF, compressors, economizer, and heat.

I The keypad shall provide the following set points as a minimum as required by selected unit options:

1 Six control modes including off manual, auto, heat/cool, cool only, heat only, and fan only.

2 Four occupancy modes including auto, occupied, unoccupied and bypass (tenant override with adjustable duration).

3 Control changeover based on return air temperature, outdoor air temperature, or space temperature.

4 Primary cooling and heating set point temperature based on supply or space temperature.

5 Night setback and setup space temperature.

6 Cooling and heating control differential (or dead band).

7 Cooling and heating supply temperature reset options based on one of the following: Return air temperature, outdoor air temperature, space temperature, airflow, or external (1–5 VDC) signal.

8 Reset schedule temperature.

9 High supply, low supply, and high return air temperature alarm limits.

10 Ambient compressor and heat lockout temperatures.

11 Compressor interstage timers duration.

12 Duct and building static pressure.

13 Minimum outdoor airflow reset based on external reset (1–5 VFD) percent of cfm capacity, and fixed outdoor damper position.

14 Economizer changeover based on enthalpy, dry bulb or network signal.

15 Current time and date.

16 Occupied/unoccupied time schedules with allowances for holiday/event dates and duration.

17 Two types of service modes including timers normal (all time delays) and timers fast (all time delays 20 seconds).

18 Tenant override time.

J Open Communications Protocol—The unit control system shall have the ability to communicate to an independent Building Management System (BMS) through a direct [BACnet ethernet] [BACnet MSTP] [LonTalk] communication connection. The independent BMS system shall have access to [quantity from specification] "read only' variables and [quantity from specification] "read & and write" variables. Communications shall not require field mounting of any additional sensors or devices at the unit. [The communications protocol shall be LONMARK 3.4 certified under the [Discharge Air] [Space Comfort] functional profiles.]

The BMS system shall be capable of interacting with the individual rooftop controllers in the following ways:

1 Monitor controller inputs, outputs, set points, parameters and alarms.

2 Set controller set points and parameters.

3 Clear alarms.

4 Reset the cooling and heating discharge air temperature set point (VAV and CAV-DTC units).

5 Reset the duct static pressure set point (VAV units).

6 Set the heat/cool changeover temperature (VAV and CAV-DTC units).

7 Set the representative zone temperature (CAV-ZTC units).

K It will be the responsibility of the Systems Integrating Contractor to integrate the rooftop data into the BMS control logic and interface stations.

2.20 Energy Recovery Wheel

A The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.

B The wheel capacity, air pressure drop and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.

C The rooftop unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.

D The unit shall have 2" Merv 7 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door with ¼ turn latches.

E The wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

F The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

G Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub,

spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning.

H Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.

I The exhaust air fan shall be a direct drive SWSI plenum fan. The exhaust fan shall be sized for the airflow requirements per the construction schedule. The unit controller shall control the exhaust fan to maintain building pressure. A VFD shall be provided for the exhaust fan motor or the exhaust fan motor shall be an ECM motor.The rooftop unit shall have single point electrical power connection and shall be ETL listed.

J The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface.

1 [Optional] The rooftop unit with the energy recovery wheel shall incorporate the economizer operation. The energy recovery wheel shall have a bypass damper. When the unit is in the economizer mode of operation the energy recovery wheel shall stop and the bypass dampers shall be opened. The outdoor air shall be drawn through the bypass dampers to reduce the pressure drop of the outdoor airstream.

2 [Optional] The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall stop the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

3 [Optional] The rooftop unit DDC controller shall provide frost prevention for the energy recovery wheel. The DDC controller will start and stop the energy wheel to prevent the wheel from reaching a frost condition.

4 [Optional] The rooftop unit DDC controller shall provide a VFD for frost prevention for the energy recovery wheel. The speed of the energy wheel shall be varied to prevent a frost condition on the wheel.

McQuay Training and Development

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Warranty

All McQuay equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local McQuay Representative for warranty details. Refer to Form 933-43285Y. To find your local McQuay Representative, go to www.mcquay.com.

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APPLICATION

E-SAVER™ - 80R and E-SAVER™ - 81R are ultra-efficient dry-type transformers that have been optimized to maximize energy savings and provide the fastest payback in the most widespread retrofit applications.

For more than a decade, Powersmiths has actively measured low-voltage transformer load profiles and losses for the thousands of transformers it has retrofitted in a wide variety of applications from K-12 schools to hospitals and college campuses, from military bases to courthouses, from mission critical high tech data centers to general commercial office buildings. In these applications, Powersmiths has found the most common profile to be a lightly loaded transformer that feeds predominately electronic equipment. Optimized specifically for this profile, E-SAVER-80R and 81R have shown to deliver an average of 80% reduction in losses per project when replacing older existing transformers.

For transformers feeding dedicated equipment like fans, motors and elevators, or heavy harmonic rich loads, see the rest of the E-Saver family as well as Powersmiths T1000.

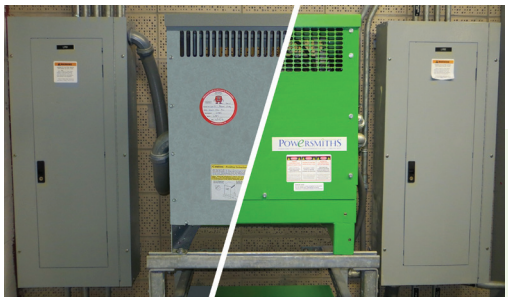
OPAL™ - OPTIMIZED DESIGNS FOR RETROFITS

There is more to a transformer retrofit than simply matching the capacity and input/output voltages with a typical transformer from the distributor's warehouse. A transformer has much more impact in an electrical system than just efficiency, since its electrical characteristics affect fault and arc flash levels as well as inrush. In a retrofit, there are other important considerations including site conditions like footprint and internal terminal layout.

To address these needs, Powersmiths has developed a transformer design best practice called OPAL™ - Optimized Performance for the Application Load. OPAL ensures compatibility by considering the system as a whole, including goals like managing impedance, arc flash, fault level, inrush, harmonics, and more. OPAL is possible thanks to the tight feedback loop between design, onsite manufacturing, and extensive ongoing real world operating performance verification. The result is the most savings per dollar spent. Our flexible design and manufacturing process enables us to deliver solutions for the wide variety of site conditions and transformer manufacturers including footprint and internal terminal layouts.

DOE 2016 IDENTIFIES BILLIONS IN SAVINGS BEYOND NEW LEGAL MINIMUM

Most manufacturers have designed their low-voltage transformers to just meet the new U.S. Dept. of Energy law (DOE 2016), setting minimum efficiency at a single required 35% load point, under an ideal sine wave factory test profile, sacrificing performance elsewhere. The DOE quantifies savings for going beyond DOE 2016 in billions of dollars. Furthermore, the DOE states that lifecycle savings can be maximized by optimizing for real-world loading. Powersmiths OPAL™ enables customers to access these savings – backed by real-world performance verification.



E-Saver OPAL-R™ Retrofits deliver maximum energy savings and follow best practices to measure & verify lifecycle savings, and ensure hassle-free transformer replacements.

RETROFITS REQUIRE A BEST PRACTICE

To replace existing transformers cost effectively, Powersmiths uses a multi-step best practice covering the entire project cycle, from vetted project savings calculations, to comprehensive site audits and tagging, individualized product selection baseline and post installation field measurement of load profile, losses and efficiency following IPMVP protocols, and performance reports, all under the supervision of professional engineers.

GUARANTEED PERFORMANCE OVER 25 YEARS

In a world filled with small print disclaimers and limited DOE compliance testing, you can count on Powersmiths performance because we guarantee that every transformer we manufacture meets our published technical data, and furthermore, that this performance is met over the full term of the 25-year pro-rated warranty. Being able to trust that savings are both real and long-term is part of why organizations choose Powersmiths.

K-RATING IS A MODERN REQUIREMENT

Many general purpose transformers are purchased and installed since they have the lowest first cost, however, they carry a UL label on the basis of feeding only linear load. Since most connected loads today are electronic with nonlinear profiles, a low-voltage transformer needs to be K-rated in order to have a valid UL listing for most applications today. E-Savers are appropriately K-rated.

EXPANDED KVA SELECTION ENABLES RIGHT-SIZING

Powersmiths enables right-sizing of electrical infrastructure by offering a much broader selection of transformer kVA sizes. The capital cost, operating cost and footprint reductions can be dramatic - on the order of 30-50%, through smaller transformers, breakers, conductors, and distribution panels.

ENVIRONMENTAL/GREEN BUILDING/LEED®/NET ZERO

By going meaningfully beyond the DOE 2016 baseline efficiency, the E-Saver™ contributes to green building, LEED®, Net Zero and carbon footprint reduction goals. Additional benefits include our ISO14001 certified manufacturing, integrated metering and ability to integrate with the Powersmiths WOW™ Sustainability Management Platform.

CERTIFICATIONS & TESTING

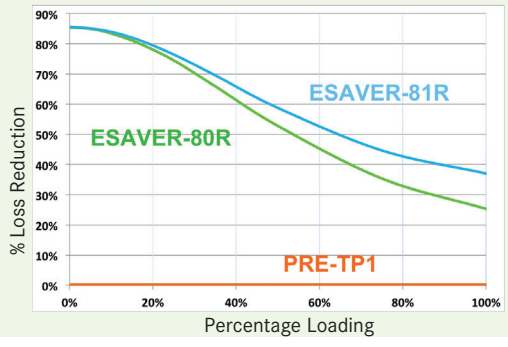
Powersmiths certifications include ISO9001 (Quality), ISO14001 (Environment) ISO17025 (Efficiency Test Lab), UL and CSA. Powersmiths has a production-integrated nonlinear load test program that enables efficiency verification under real-world conditions, as well as Certified Test Lab Profile Test Reports.

METERING & ARC FLASH OPTIONS

Integrated metering can provide information about capacity utilization, load profiles, power quality and energy use. The lockable hinged door option as well as our patented 360º Rotatable IR Port™ option enable quick and safe access to internal transformer connections, and reduces arc flash risk.

Powersmiths offers also transformers with Integrated Power Distribution, see the Energy Station TX brochure.

E-SAVER OPAL-R™ Loss Reduction Curves



KEY FEATURES

- Optimized for light, nonlinear loads found in most applications K-rated as required by UL to feed modern electronic equipment
- Retrofit Best Practice ensures a smooth retrofit with verified savings
- Significant savings beyond DOE 2016 legislation
- Electrical system consideration: impedance, inrush, fault & arc flash levels
- Available with a wide range of safety & performance features like integrated hinged doors, 360º Rotatable IR Port™, and Cyberhawk™ Metering and Logging
- Manufactured in a certified ISO 9001, ISO 14001 and ISO 17025 facility for quality, low environmental impact, and transformer efficiency testing

[1] U.S. Dept. of Energy 10 CFR Part 431, [Docket No. EERE–2010–BT–STD–0048] Energy Conservation Program: Energy Conservation Standards for Distribution Transformers, Final Rule April 18, 2013.

TECHNICAL SPECIFICATIONS

The E-Saver™-80R and 81R are ultra-efficient low-voltage dry-type transformers that meaningfully exceed the U.S. Dept. of Energy's new minimum efficiency law, commonly referred to as DOE 2016. All E-Saver transformers carry a UL Listing and CSA Approval, with application appropriate K-factor.

The aluminum wound E-Saver-80R and the copper wound E-Saver-81R are both K-factor listed per UL 1561 and are K-7 rated per C57.110. Both models are compatible with electronic equipment all the way up to full load.

E-Savers have a common-core (3-phase models), 10kV BIL, 200% rated neutral, are 60Hz rated (std), built to NEMA ST-20, UL1561, IEEE C57.110 and other applicable ANSI and IEEE standards. Both primary and secondary terminals and voltage taps (typically six 2.5%) are all front-accessible. E-Savers have a 220°C class insulation system that is NOMEX-based with an Epoxy Co-polymer impregnant with technical performance characteristics that embed lower environmental impact, long term reliability and long life expectancy. E-Savers carry OSHPD and IBC Seismic Certification. The seismic bracing option provides a higher 2.28g certification. All E-Saver models come standard in a Type 2 ventilated drip-proof indoor enclosure made of heavy gauge steel finished with epoxy powder coating for durability and low environmental impact, and are UL Listed for 2" rear clearance - a significant improvement over the typical industry 6" limit. A wide variety of enclosures and options are available.

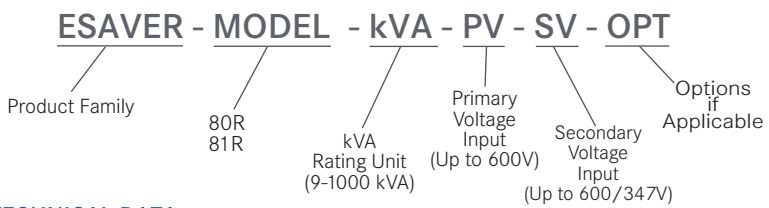
Low Noise: Keeping audible noise at a minimum is key. While the NEMA ST-20 standard sets levels referenced by industry only a type test, not a production test, is required – so transformers on actual projects may be noisy. Powersmiths builds 3dB quieter than NEMA standard values, and furthermore every unit is tested to ensure quiet operation. For very sensitive environments an additional 2dB lower noise option is available.

Management of Impedance, Inrush, Fault Level, Arc Flash: Powersmiths OPAL™ design best practice includes addressing key transformer attributes like impedance, inrush, fault level, arc flash, to ensure smooth integration into an electrical system, avoiding the negative impacts often associated with high efficiency transformers. See individual technical data sheets for comprehensive values for all parameters.

Impedance: For both the E-Saver-80R and E-Saver-81R, impedance is kept at or above 4.0% in order to manage downstream fault current and arc flash levels, and maintain compatibility with equipment interrupting capacity (kAIC) ratings. Higher impedance is available to meet specific project needs.

Inrush: Inrush currents are managed in order to avoid nuisance tripping of the primary breaker and to enable design engineers to use standard 125% rated primary protection, thereby avoiding expensive design changes that otherwise may be needed. Very Low Inrush designs are available as specific projects may require, for example some datacenter and medical applications.

ORDERING INFORMATION



TECHNICAL DATA

kVA	Audible Noise	80R, 81R Model Weight Range (lbs)	Standard Case Size (in)	Alternate Smaller Case Size (in)
15	42 dB	230-300	17.5W x 17D x 27.5H	17.5W x 14.5D x 25H
20	42 dB	260-340	25.5W x 18D x 30H	23W x 15.5D x 27.5H
25	42 dB	300-380	25.5W x 18D x 30H	23W x 15.5D x 27.5H
30	42 dB	340-420	25.5W x 18D x 30H	23W x 15.5D x 27.5H
45	42 dB	400-540	25.5W x 18D x 30H	25.5W x 16D x 29H
50	42 dB	450-600	25.5W x 18D x 30H	No Alternate
63	47 dB	500-650	31.5W x 21.5D x 40H	26.5H x 20D x 33H
75	47 dB	610-700	31.5W x 21.5D x 40H	26.5H x 20D x 33H
100	47 dB	675-900	31.5W x 21.5D x 40H	30.5H x 20D x 35H
112	47 dB	770-990	31.5W x 21.5D x 40H	30.5H x 20D x 35H
125	47 dB	875-1120	37.5W x 26.5D x 48H	33W x 23D x 38H
150	47 dB	1010-1230	37.5W x 26.5D x 48H	33W x 23D x 38H
175	52 dB	1100-1360	37.5W x 26.5D x 48H	34.5W x 26.5D x 42H
200	52 dB	1175-1450	37.5W x 26.5D x 48H	34.5W x 26.5D x 42H
225	52 dB	1295-1600	37.5W x 31.5D x 52H	34.5W x 26.5D x 42H
250	52 dB	1400-1800	37.5W x 31.5D x 52H	37.5W x 26.5D x 48H
300	52 dB	1575-1960	37.5W x 31.5D x 52H	37.5W x 26.5D x 48H
400	57 dB	2025-2450	51.5W x 38D x 61H	43.5W x 33.5D x 55.5H
450	57 dB	2200-2600	51.5W x 38D x 61H	43.5W x 33.5D x 55.5H
500	57 dB	2475-2900	51.5W x 38D x 61H	43.5W x 33.5D x 55.5H
600	59 dB	2725-3600	64W x 47D x 67H	51.5W x 38D x 61H
750	61 dB	3200-4300	64W x 47D x 67H	Contact Factory
850	61 dB	3600-5000	64W x 53D x 67H	Contact Factory
1000	61 dB	4200-6000	64W x 53D x 67H	Contact Factory

AVAILABLE OPTIONS

Metering: Express Logger™, SMART™ or Cyberhawk TX™ (see product cut sheets for details)
CC: Core & Coils available for OEM Integration
3R: Type 3R, sprinkler proof/outdoor ventilated enclosure
OSEC: Enclosure for outdoor public areas
SS: Painted stainless steel enclosure
NVI: Non-ventilated indoor enclosure
IRP: 360º Rotatable IR Port™
HD: Hinged Door
F50: 50 Hz design
1S: Single electrostatic shield
2S: Dual electrostatic shields
3S: Triple electrostatic shields
SPD: (120/208 V OR 277/480V)
- **PRO80:** 80kA, 7 mode, Filter
- **PRO120:** 120kA, 7 mode, Filter
- **PRO200:** 200kA, 7 mode, Filter
- **PRO240:** 240kA, 7 mode Filter
- **PROXX:** Where XX is custom ID

LKS: Lug kit, screw-type
LKC: Lug kit, compression type
VLI: Very Low Inrush
IMP: Custom Impedance
COL: Custom color
TS: Thermal sensors at 170°C and 200°C
RTR: Routine Test Report
NLT: Nonlinear Load Test with Certificate
2016TR: DOE 2016 Test Report
CTL: ISO 17025 Certified Test Lab, load profile test
SE: Sensitive environment, extra low noise
SB: Certified Seismic bracing for 2.28g (for Certificate details contact Powersmiths)
WM: Wall-mount kit up to 75kVA is available (sold separately)

NOTE: The above data applies to the standard configuration of each kVA. Selection of some options may change enclosure size and/or transformer weight. Some options may be mutually exclusive. Consult factory for detailed product data sheet for these and other configurations. Efficiencies tested according to U.S. Dept. of Energy's 10 CFR Part 431, a linear load test at 35% of nameplate capacity. Refer to technical data sheet for comprehensive information for each specific model, kVA, and option selected.

As design optimization is continuous, technical data is updated over time. Please check with Powersmiths for latest revision.

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POWERSMITHS

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WWW.POWERSMITHS.COM

807-000431-156-A 02

China

KOHLER®

Kingston™
Bowl
K-4325

815500

Features
- Vitreous china.
- Elongated bowl.
- Siphon jet.
- Wall-mount.
- 1-1/2" top spud.
- 1.28 gpf (4.8 lpf) or 1.6 gpf (6 lpf) depending on flushometer specified.
- 10-1/2" (267 mm) x 9" (229 mm) water area.
- 26-1/2" (673 mm) x 16-1/2" (419 mm) x 13-1/4" (337 mm).
- Will replace K-4330 and K-4330-L bowls.



Optional Accessories
K-10673 WAVE Touchless Toilet 1.28 gpf Flushometer
K-13516 Manual 1.6 GPF WC Flushometer
K-13517 Manual 1.28 GPF WC Flushometer
K-10674-SV WAVE DC 1.6 GPF WC Flushometer
K-10956-SV Tripoint™ DC 1.28 GPF WC Flushometer
K-10957-SV Tripoint™ DC 1.6 GPF WC Flushometer
K-4731-C Commercial Heavy-duty Toilet Seat
K-4731-GC Commercial Heavy-duty Toilet Seat
K-4731-SC Commercial Heavy-duty Toilet Seat
K-10956 Tripoint™ DC 1.28 GPF WC Flushometer
K-10674 Wave DC 1.6 GPF WC Flushometer
K-10957 Tripoint™ DC 1.6 GPF WC Flushometer

Components
Additional included component/s: Spud.

ADA **CSA B651**

WaterSense Meets EPA Criteria Certified by IAPMO R&T

Codes/Standards
ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®
California Energy Commission (CEC)
ADA
ICC/ANSI A117.1
CSA B651

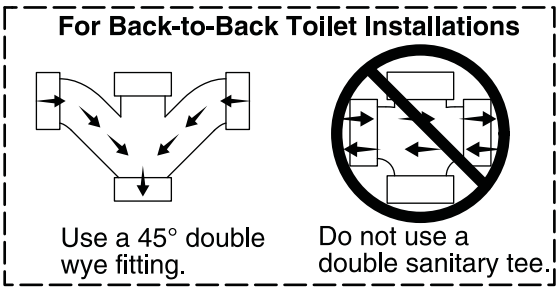
KOHLER® One-Year Limited Warranty
See website for detailed warranty information.

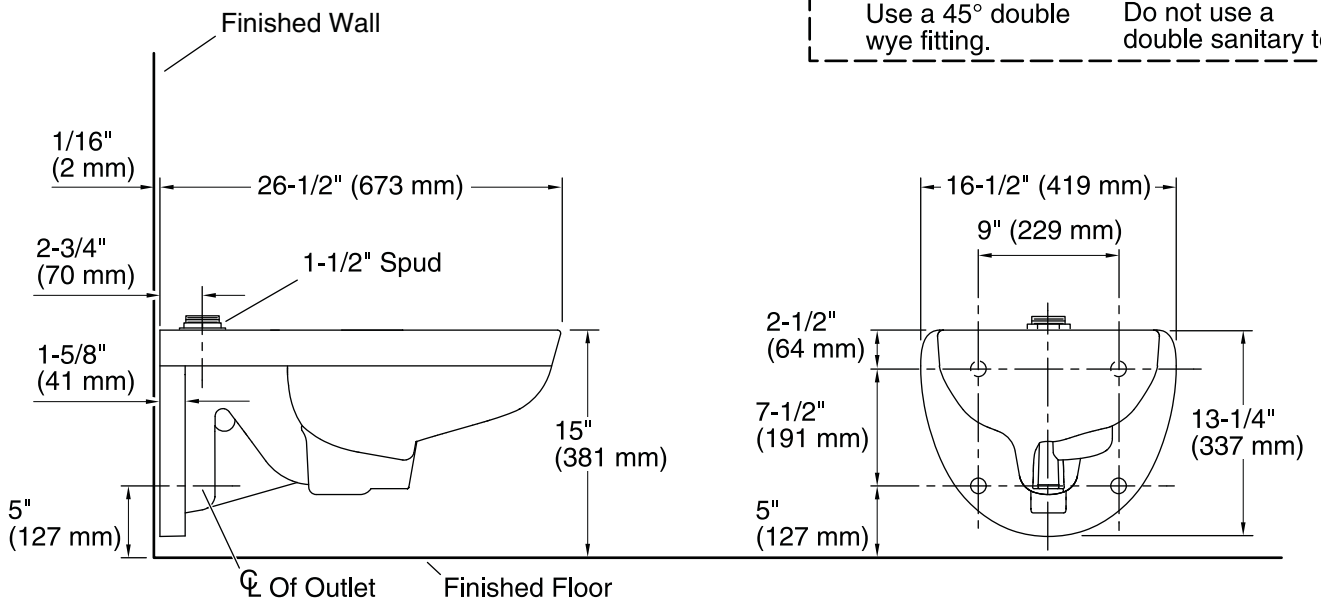
Available Color/Finishes
Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	7	Black Black™

KOHLER®

Kingston™
Bowl
K-4325





Technical Information

All product dimensions are nominal.

Toilet type:	Flushometer
Bowl shape:	Elongated front
Spud size:	1-1/2", Inlet, Top
Trap passageway:	2-1/8" (54 mm)
Water surface size:	10-1/2" x 9" (267 mm x 229 mm)
Rim to water surface:	5-1/4" (133 mm)
Seat-mounting holes:	5-1/2" (140 mm)

Fixture Supply Requirements

Min static pressure:	35 psi (241.3 kPa)
Max static pressure:	80 psi (551.6 kPa)
Min flowing pressure:	25 psi (172.4 kPa)
Min flow rate:	25 gpm (94.6 lpm)

Notes

Install this product according to the installation instructions.

Refer to manufacturer's instructions and local codes for flushometer requirements.

For back-to-back toilet installations: Use only a 45° double wye fitting.

ADA, CSA B651 compliant when installed to the specific requirements of these regulations.

The Model Plumbing Codes require the installation of elongated open-front toilet seats on public bathrooms.

815500

Z5655-BWL1

HET Elongated Floor Mounted
EcoVantage® Flush Valve Toilet System

TAG _____

817658



Z5655 Series Elongated

Z5655 HET Series

- Zurn High Efficiency Toilets and paired performance flush valve systems are designed to exceed industry standards while using as little as 1.1 gallons of water per flush.
- Universal high efficiency toilet can be specified with 1.1 gpf [4.2 lpf],1.28 gpf [4.8 lpf], 1.6 gpf [6.0 lpf] or dual flush valves.
- Vitreous china
- Elongated front rim
- 2-1/8" fully glazed trapway
- High efficiency siphon jet flush action
- Shipping Weight: 55 lbs.

Recommended Trim:

☐ **Z5955SS-EL** Elongated, standard white, open front toilet seat less cover with stainless steel check hinge.

☐ **Z5972-COMB** Closet bolt/wax ring kit

Note: To ensure system performance:
Minumum Running Water Pressure = 25 psi

This product should be used with a WaterSense labeled counterpart with a compatible flush volume to ensure that the entire system meets the requirements for water efficiency and performance.

Engineering Specification

☐ **Z5655-BWL1**
EcoVantage High Efficiency Toilet System
Vitreous China, 1.1 gpf [4.16 lpf] or greater high efficiency, floor mounted, bottom outlet toilet with siphon jet flushing action and elongated front rim with 1-1/2” top spud. This bowl is designed to perform to industry standards with as little as 1.1 gallons per flush.
*Replaces Zurn Z5655

☐ **Z5656-BWL1**
EcoVantage High Efficiency Toilet System
Vitreous China, 1.1 gpf [4.16 lpf] or greater high efficiency, floor mounted, bottom outlet toilet with siphon jet flushing action and elongated front rim with integral bedpan lugs, and 1-1/2” top spud. This bowl is designed to perform to industry standards with as little as 1.1 gallons per flush.
*Replaces Zurn Z5656

See Zurn One Systems for suggested packages.

Architectural/Engineering Approval

These dimensions and specifications are subject to change without notice.
Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

ZURN INDUSTRIES, LLC. ♦ COMMERCIAL BRASS OPERATION ♦ 5900 ELWIN BUCHANAN DRIVE ♦ SANFORD NC 27330
Phone: 1-800-997-3876 ♦ Fax: 919-775-3541 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 7900 Goreway Drive Unit 10 ♦ Brampton, Ontario L6T5W6 ♦ Phone: 905-405-8272 Fax: 905-405-1292

EcoVantage® and AV are registered trademarks of Zurn Industries, LLC.

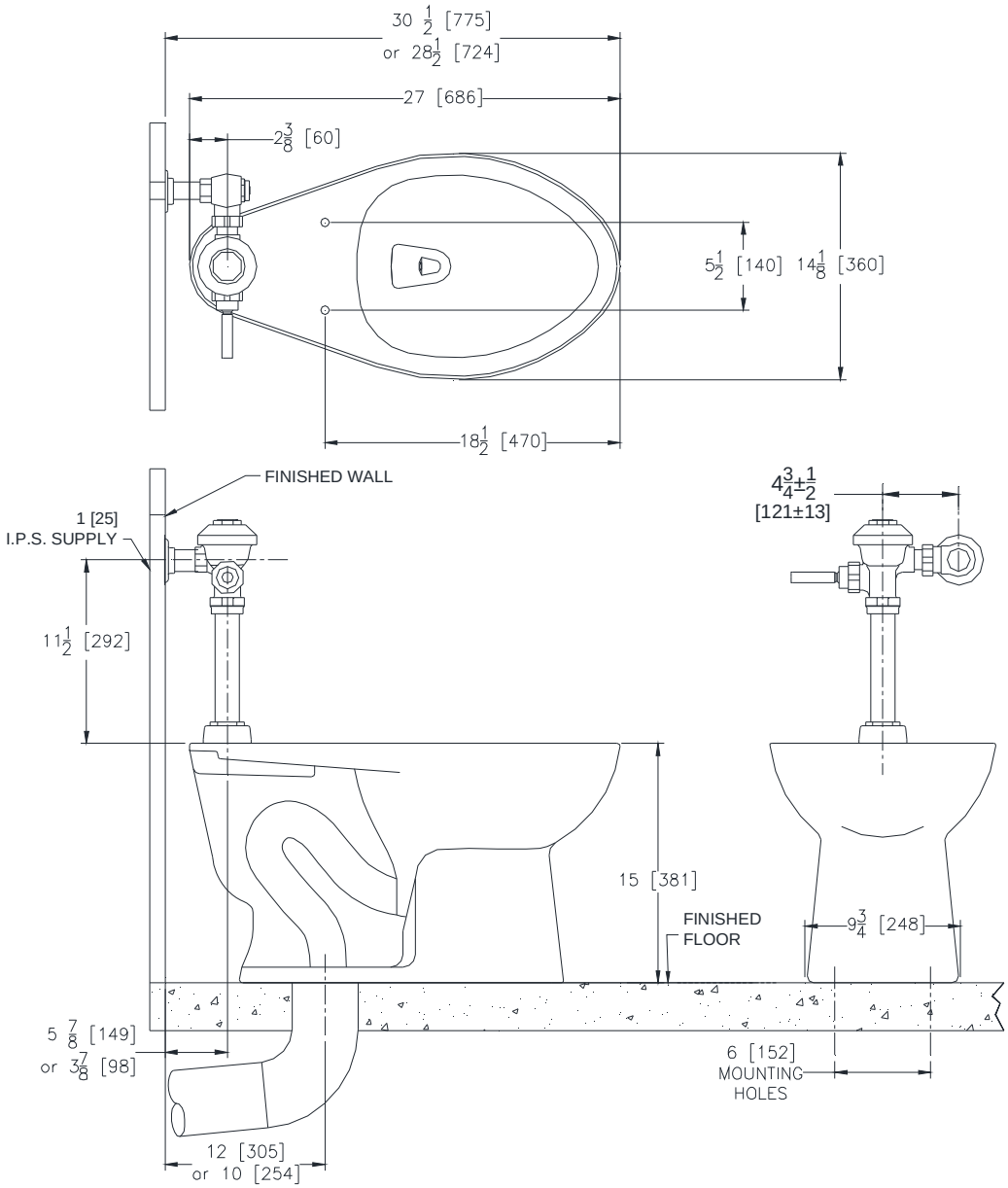
Z5655-BWL1

HET Elongated Floor Mounted
EcoVantage® Flush Valve Toilet System

TAG _____

817658

Rough-in dimensions for Z5655 Series
• Z5655 with top spud, shown with Z6000AV-HET manual valve



These dimensions and specifications are subject to change without notice.
Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

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Z5665-BWL

TAG _____

HET Elongated Floor Mounted, ADA Height EcoVantage Flush Valve Toilet System



Z5665 Series Elongated

Recommended Trim:

☐ **Z5955SS-EL** Elongated, standard white, open front toilet seat less cover with stainless steel check hinge.

☐ **Z5972-COMB** Closet bolt/wax ring kit

Note: To ensure system performance:
Minimum Running Water Pressure = 25 psi.

Z5665 HET Series

- Zurn High Efficiency Toilets and paired performance flush valve systems are designed to exceed industry standards while using as little as 1.1 gallons of water per flush.
- Universal high efficiency toilet can be specified with 1.28 gpf [4.8 lpf], 1.6 gpf [6.0 lpf] or dual flush valves.
- Vitreous china
- ADA height
- Elongated front rim
- 2 1/8" fully glazed trapway
- High efficiency siphon jet flush action
- Shipping Weight: 57 lbs.

1155083

Engineering Specification

☐ **Z5665-BWL**

EcoVantage High Efficiency Toilet System
Vitreous China, 1.1 gpf [4.16 lpf] or greater high efficiency, ADA, floor mounted, bottom outlet toilet with siphon jet flushing action and elongated front rim with 1-1/2" top spud. This bowl is designed to perform to industry standards with as little as 1.1 gallons per flush.
*Replaces Zurn Z5660

☐ **Z5666-BWL**

EcoVantage High Efficiency Toilet System
Vitreous China, 1.1 gpf [4.16 lpf] or greater high efficiency, ADA, floor mounted, bottom outlet toilet with siphon jet flushing action and elongated front rim with integral bedpan lugs, and 1-1/2" top spud. This bowl is designed to perform to industry standards with as little as 1.1 gallons per flush.
*Replaces Zurn Z5661

These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when installed according to these requirements.

EcoVantage® is a registered trademark of Zurn Industries

Architectural/Engineering Approval

See Zurn One Systems for suggested packages.

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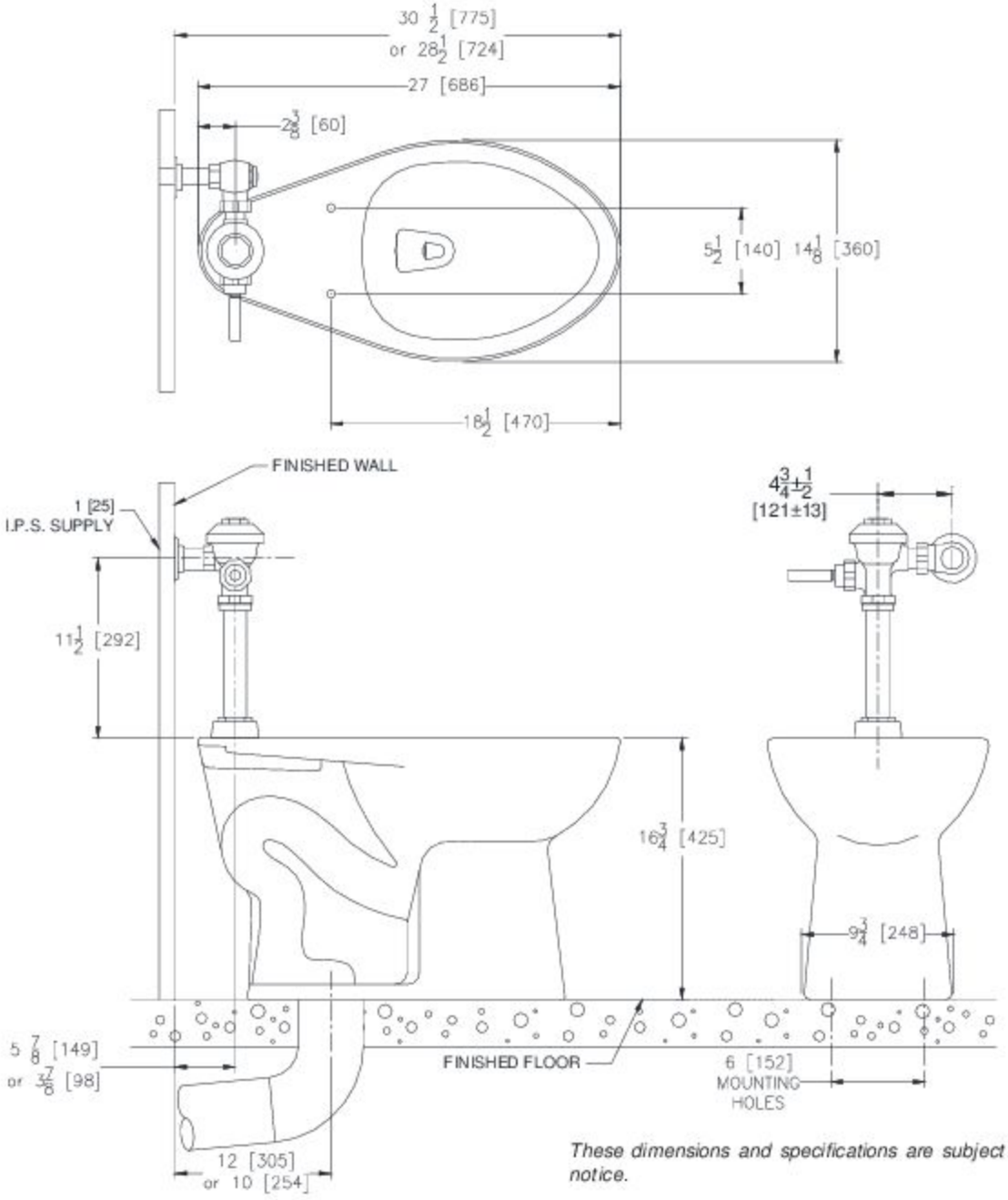
Z5665-BWL

TAG _____

HET Elongated Floor Mounted, ADA Height EcoVantage Flush Valve Toilet System

Rough-in dimensions for Z5665 Series

- Z5665 with top spud, shown with Z6000AV-HET valve



These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when installed according to these requirements.

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Rev. E
Dwg. No. 84358
Date: 3/2
Product No. Z5665-E

1155083

Z5758.207.00

"The Retrofit Pint®" 1/8 gpf, EcoVantage®, Ultra Low Consumption, Urinal System

TAG _____



GreenSpec® LISTED
www.GreenSpec.com

ADA DESIGNED

Z5758.207.00 SERIES

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

This product should be used with a WaterSense labeled counterpart with a compatible flush volume to ensure that the entire system meets the requirements for water efficiency and performance.

Z5758.207.00 Series

- Zurn One ultra low consumption urinal system designed for optimal performance between Zurn fixture and Zurn flush valve to save water while exceeding industry performance standards
- 1/8 gallons per flush [0.5 Liters per flush]
- Vitreous china
- High efficiency washout flushing action
- Over 88% water savings over standard 1.0 gpf [4.0 Lpf] system
- Manual ADA, non-hold open handle actuation
- Universal Bracket and oversized footprint to make retro-fit easy
- 3/4" top spud
- 2" I.P.S. outlet flange and rubber gasket with integral trap
- 14" extended rim for handicap compliance when installed at proper height
- Vandal resistant outlet strainer included
- Shipping Weight: 72 lbs.

ENGINEERING SPECIFICATION:

☐ **Z5758.207.00 EcoVantage® Manual High Efficiency Urinal (HEU) System -** System comes complete with exposed Z6003AV-ULF high efficiency flushometer valve with manual handle actuation and vitreous china urinal. The system is designed to perform to industry standards with as little as 1/8th gallon per flush. The valve is an exposed, quiet diaphragm-type, chrome plated flushometer valve with a polished exterior. Complete with Zurn's AquaVantage® TPE, chloramine resistant, dual seal diaphragm with a clog-resistant filtered by-pass. The valve is ADA compliant with a non-hold open and no leak handle feature, high back pressure vacuum breaker, one piece hex coupling nut, adjustable tailpiece, spud coupling and flange for top spud connection. Control stop has internal siphon-guard protection, vandal resistant stop cap, sweat solder kit, and a cast wall flange with set screw. Vitreous china urinal is supplied with 3/4" top spud, 2" outlet connection, vandal resistant outlet strainer and universal retrofit hanger bracket.

These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standards A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 17" [432 mm] from finished floor.

ADA DESIGNED

This space is for Architectural/engineering Approval

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Phone: 1-800-997-3876 ♦ Fax: 919-775-3541 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 7900 Goreway Drive Unit 10 ♦ Brampton, Ontario L6T5W6 ♦ Phone: 905-405-8272 Fax: 905-405-1292

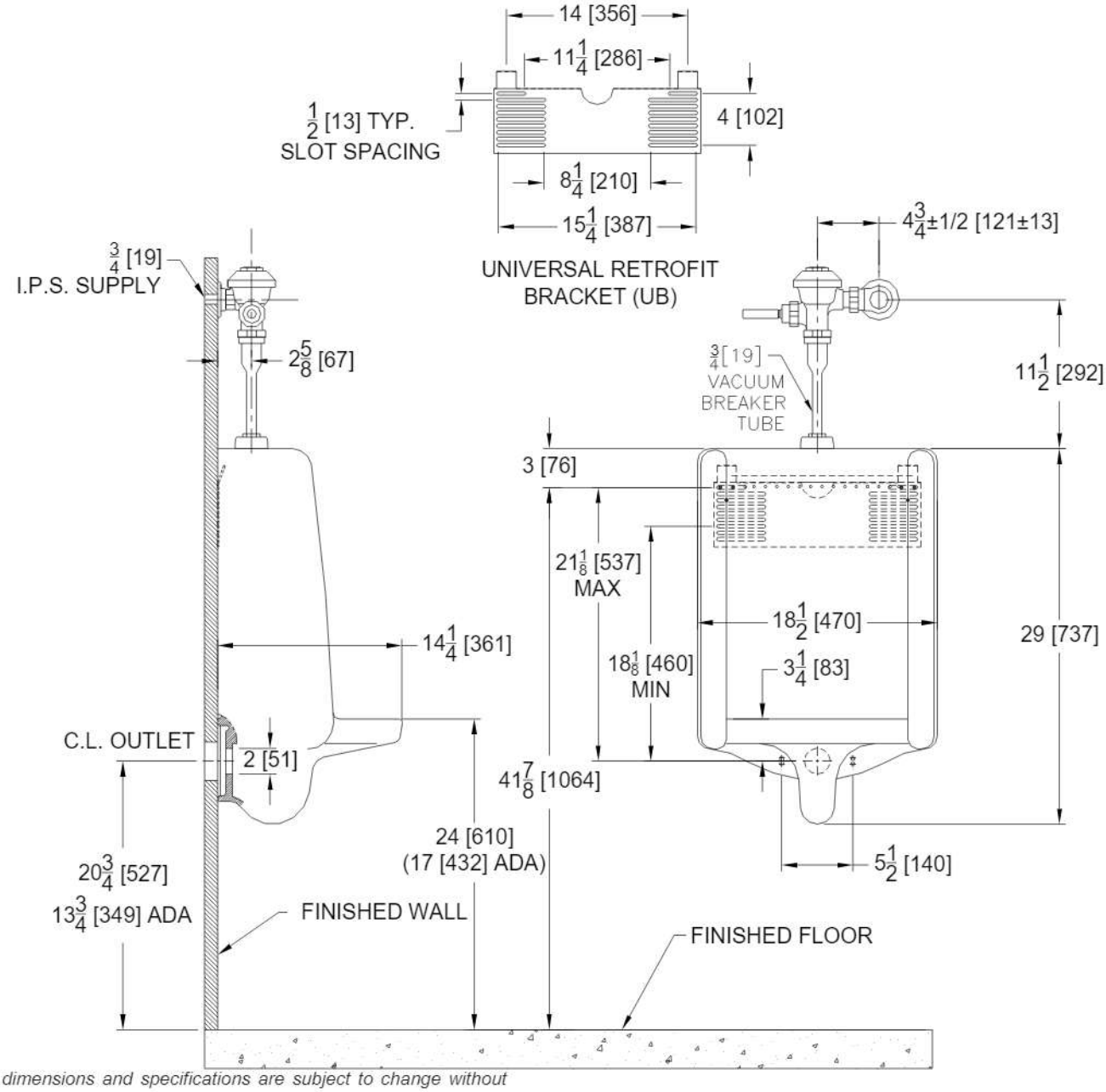
EcoVantage® is registered trademarks of Zurn Industries, LLC.
The Pint® is registered trademarks of Zurn Industries, LLC.

Z5758.207.00

"The Retrofit Pint®" 1/8 gpf, EcoVantage®, Ultra Low Consumption, Urinal System Rough-In

TAG _____

Rough-in dimensions for Z5758.207.00 series



These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standards A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 17" [432 mm] from finished floor.

ADA DESIGNED

GreenSpec® LISTED
www.GreenSpec.com

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Rev. A
Dwg. No. 84149
Date: 4/18/2017
Product No. Z5758.207.00

Z5755-U

TAG _____

Omni-Flo™ Top Spud Urinal
0.125 gpf to 1.0 gpf



Z5755 Series *Shown with ZTR6203 Flush Valve

Recommended Trim:

- ☐ **ZTR6203-ULF-LL**
  Sensor Long Life Battery Operated Urinal Flush Valve. 0.125 gpf[0.5 Lpf]
- ☐ **ZTR6203-QRT-LL**
  Sensor Long Life Battery Operated Urinal Flush Valve. 0.25 gpf[1.0 Lpf]
- ☐ **ZTR6203-EWS-LL**
  Sensor Long Life Battery Operated Urinal Flush Valve. 0.5 gpf [1.9 Lpf]
- ☐ **ZTR6203-WS1-LL**
  Sensor Long Life Battery Operated Urinal Flush Valve. 1.0 gpf [3.8 Lpf]

These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 432mm (17") from finished floor.

ZURN INDUSTRIES, LLC. ♦ COMMERCIAL BRASS OPERATION
5900 ELWIN BUCHANAN DRIVE ♦ SANFORD NC 27330
Phone: 1-800-997-3876 ♦ Fax: 919-775-3541
www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED
3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2
Phone: 905-405-8272 Fax: 905-405-1292

Z5755 Urinal Series

- Zurn Ultra Low Consumption Urinal designed for optimal performance when paired with Zurn flush valve to save water while exceeding industry performance standards
- Based on flush valve it can flush 0.125 gpf [0.5 Lpf] to 1.0 gpf [3.8 Lpf]
- Vitreous china
- Asymmetric backwall resulting in reduced splash back
- Patent Pending
- High efficiency washdown flushing action
- Oversized footprint to make retrofit easy
- 3/4" top spud
- 2" I.P.S. outlet flange and rubber gasket with integral trap
- 14" extended rim for handicap compliance when installed at proper height
- Vandal resistant outlet strainer included

Engineering Specification:

- ☐ **Z5755 EcoVantage® Urinal**
  0.125 gpf [0.5 Lpf] to 1.0 gpf [3.8 Lpf] vitreous china, wall hung, integral trap, washdown urinal complete with 3/4" top spud connection, concealed universal retrofit wall bracket, 2" outlet connection and vandal resistant outlet strainer.

***Replaces Zurn Z5750 and Z5798-U**

Architectural/Engineering Approval

See Zurn One Systems for suggested packages.

The information contained in this document is subject to change without notice.
Please contact Zurn for most up to date information.

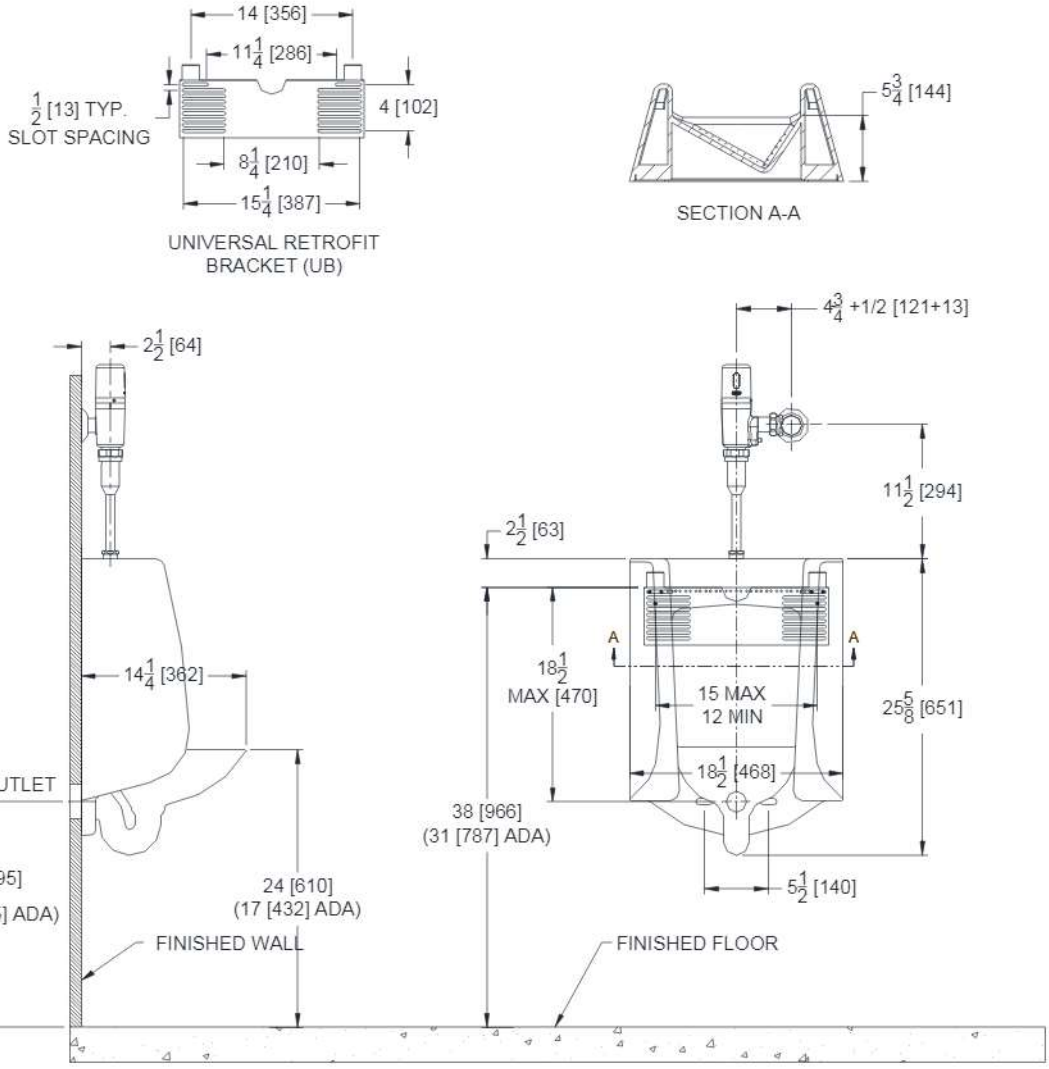
EcoVantage® is a registered trademark of Zurn Industries, LLC.

Z5755-U

TAG _____

Omni-Flo™ Top Spud Urinal
0.125 gpf to 1.0 gpf

Rough-in dimensions for Z5755-U Series



These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 432mm (17") from finished floor.

ZURN INDUSTRIES, LLC. ♦ COMMERCIAL BRASS OPERATION
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Phone: 905-405-8272 Fax: 905-405-1292

EcoVantage® is a registered trademark of Zurn Industries, LLC.

Z5738.207.00

"The Small Pint®" 1/8 gpf, EcoVantage®, Ultra Low Consumption, Urinal System

TAG _____



GreenSpec® LISTED
www.GreenSpec.com

ADA DESIGNED

Z5738.207.00 SERIES

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

This product should be used with a WaterSense labeled counterpart with a compatible flush volume to ensure that the entire system meets the requirements for water efficiency and performance.

These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standards A112.19.2 and CAN/CSA B45 requirements.

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 17" [432 mm] from finished floor.

ADA DESIGNED

Z5738.207.00 Series

- Zurn One ultra low consumption urinal system designed for optimal performance between Zurn fixture and Zurn flush valve to save water while exceeding industry performance standards
- 1/8 gallons per flush [0.5 Liters per flush]
- Vitreous china
- High efficiency washout flushing action
- Over 88% water savings over standard 1.0 gpf [4.0 Lpf] system
- Manual ADA, non-hold open handle actuation
- 3/4" top spud
- 2" I.P.S. outlet flange and rubber gasket with integral trap
- 14" extended rim for handicap compliancE when installed at proper height
- Vandal resistant outlet strainer included
- Shipping Weight: 39 lbs.

ENGINEERING SPECIFICATION:

☐ **Z5738.207.00 EcoVantage® Manual High Efficiency Urinal (HEU) System -** System comes complete with exposed Z6003AV-ULF high efficiency flushometer valve with manual handle actuation and vitreous china urinal. The system is designed to perform to industry standards with as little as 1/8th gallon per flush. The valve is an exposed, quiet diaphragm-type, chrome plated flushometer valve with a polished exterior. Complete with Zurn's AquaVantage® TPE, chloramine resistant, dual seal diaphragm with a clog-resistant filtered by-pass. The valve is ADA compliant with a non-hold open and no leak handle feature, high back pressure vacuum breaker, one piece hex coupling nut, adjustable tailpiece, spud coupling and flange for top spud connection. Control stop has internal siphon-guard protection, vandal resistant stop cap, sweat solder kit, and a cast wall flange with set screw. Vitreous china urinal is supplied with 3/4" top spud, 2" outlet connection, vandal resistant outlet strainer and retrofit hanger bracket.

This space is for Architectural/engineering Approval

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In Canada: ZURN INDUSTRIES LIMITED ♦ 7900 Goreway Drive Unit 10 ♦ Brampton, Ontario L6T5W6 ♦ Phone: 905-405-8272 Fax: 905-405-1292

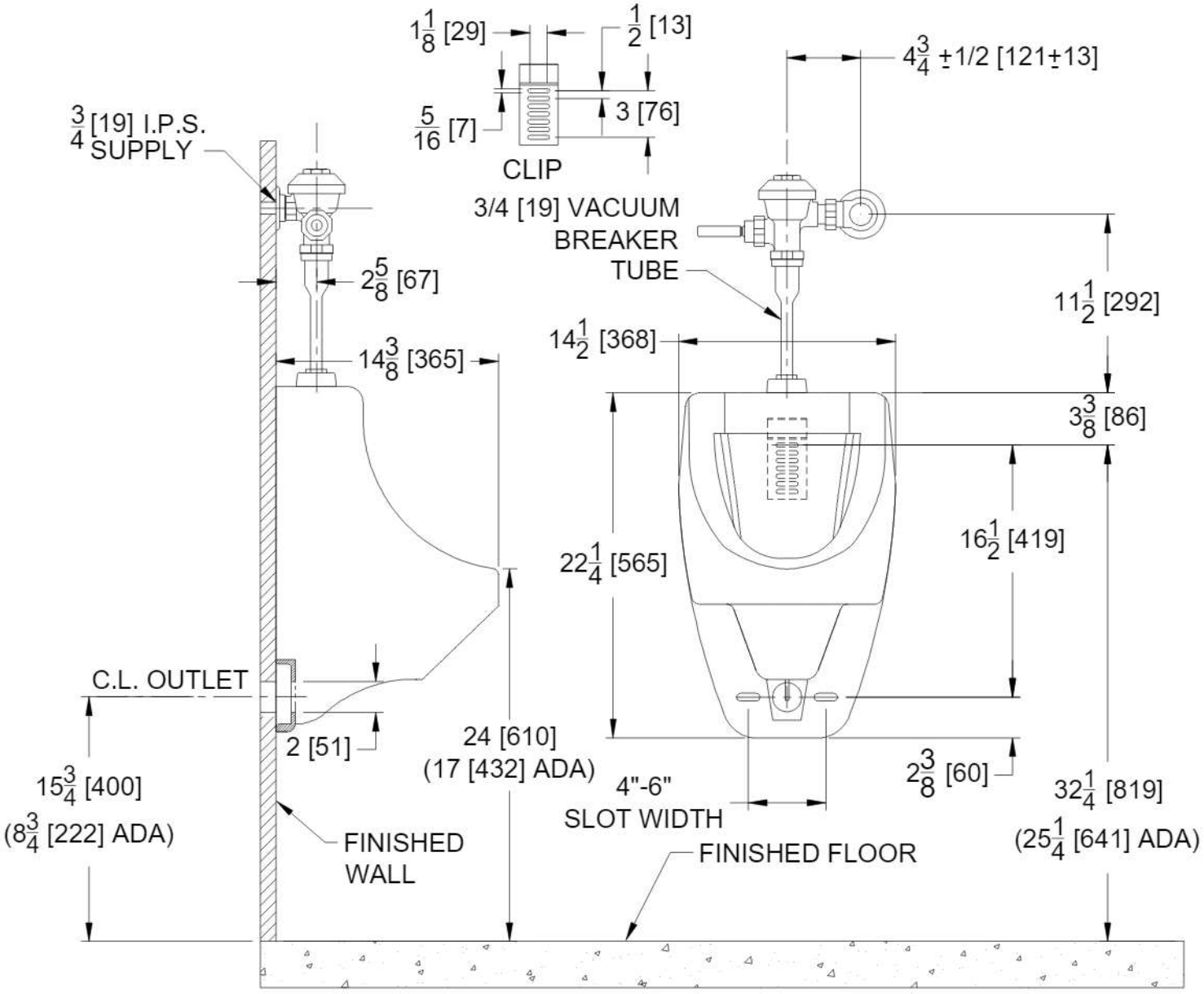
EcoVantage® is registered trademarks of Zurn Industries, LLC.
The Pint® is registered trademarks of Zurn Industries, LLC.

Z5738.207.00

"The Small Pint®" 1/8 gpf, EcoVantage®, Ultra Low Consumption, Urinal System Rough-In

TAG _____

Rough-in dimensions for Z5738.207.00 Series
*Z5738 with top spud



These dimensions and specifications are subject to change without notice.

Fixture dimensions meet ANSI/ASME standard A112.19.2 and CAN/CSA B45 requirements.

GreenSpec® LISTED
www.GreenSpec.com

Meets the American Disabilities Guidelines and ANSI A117.1 requirements when urinal is installed 17" [432 mm] from finished floor.

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Phone: 1-800-997-3876 ♦ Fax: 919-775-3541 ♦ World Wide Web: www.zurn.com
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Rev. A
Dwg. No. 200338
Date: 4/18/2017
Product No. Z5738.207.00

Flushvalves

ZURN®

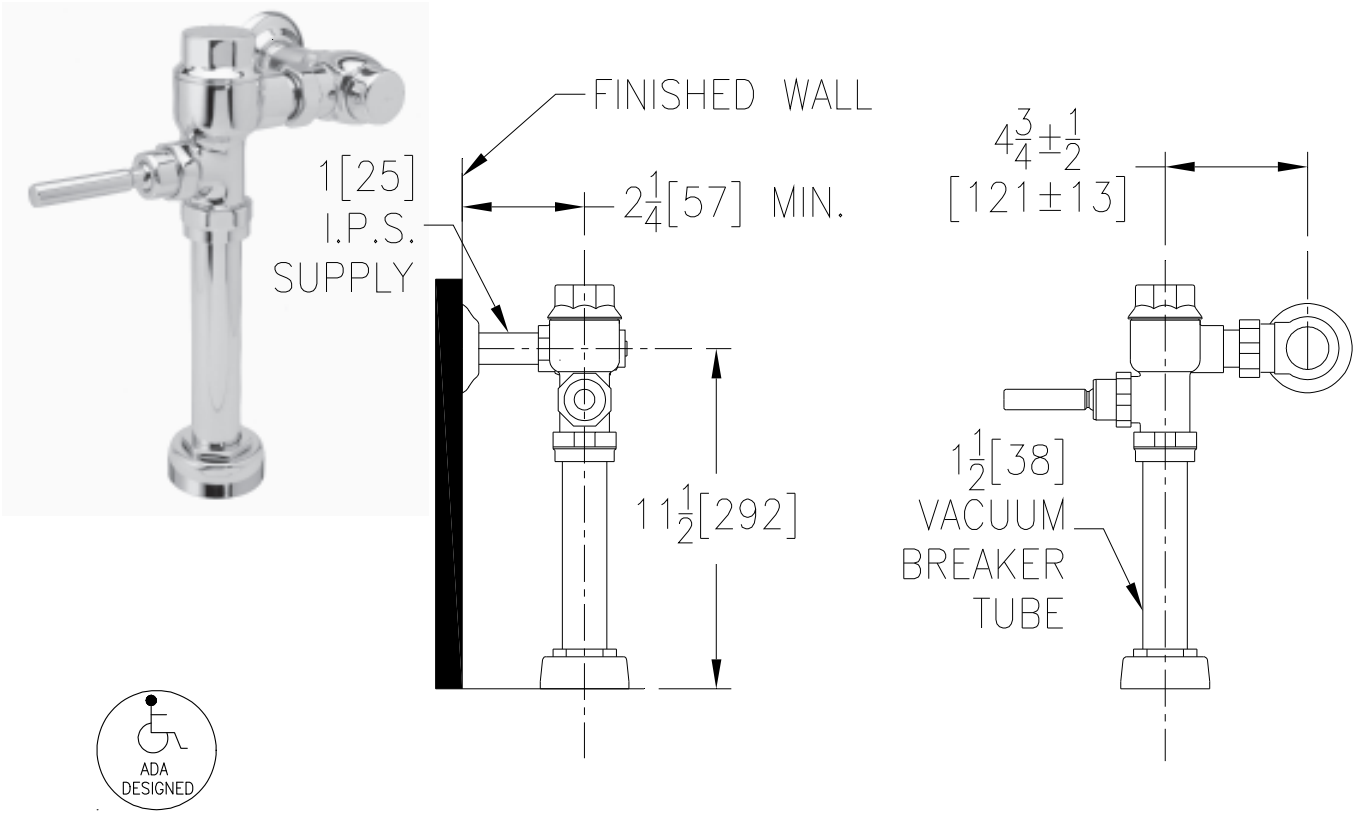
Metroflush®

TAG _____

Exposed Z6200-HET Model

Metroflush® Piston Operated Flush Valve For Water 1.28 gpf Water Closets

9341187



ADA DESIGNED

Suffix Options (Check/Specify Appropriate Options)

_____	**-VC**	Vandal Resistant Stop Cap
_____	**-XYV**	Less Vacuum Breaker
_____	**-YJ**	Split Ring Pipe Support
_____	**-YK**	Solid Ring Pipe Support
_____	**-YL**	Solid Ring Pipe Support with Bumper
_____	**-YO**	Bumper On Angle Stop
_____		Other

This space is for Architectural/engineering Approval

ENGINEERING SPECIFICATION: ZURN Z6200-HET Metroflush® Piston Operated Exposed Closet Flush Valve for 1.28 gpf Water Closet- The Ecovantage® MetroFlush® is an exposed, quiet type, chrome plated flushometer valve with polished exterior. Complete with Zurn's 1.28 gpf MetroVantage®, chloramine resistant, piston with a clog resistant, filtered by-pass. The valve is ADA compliant with a non-hold open and no-leak handle feature, high back pressure vacuum breaker, one piece hex coupling nut, adjustable tailpiece, spud coupling and flange for top spud connection. Control stop has internal siphonguard protection, sweat solder kit, and a cast wall flange with set screw. Internal seals are made of chloramine resistant materials.

The information contained in this document is subject to change without notice.
Please contact Zurn for most up to date information.

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Metroflush® is a trademark of Zurn Industries, LLC.

ZURN

AquaSense® Model

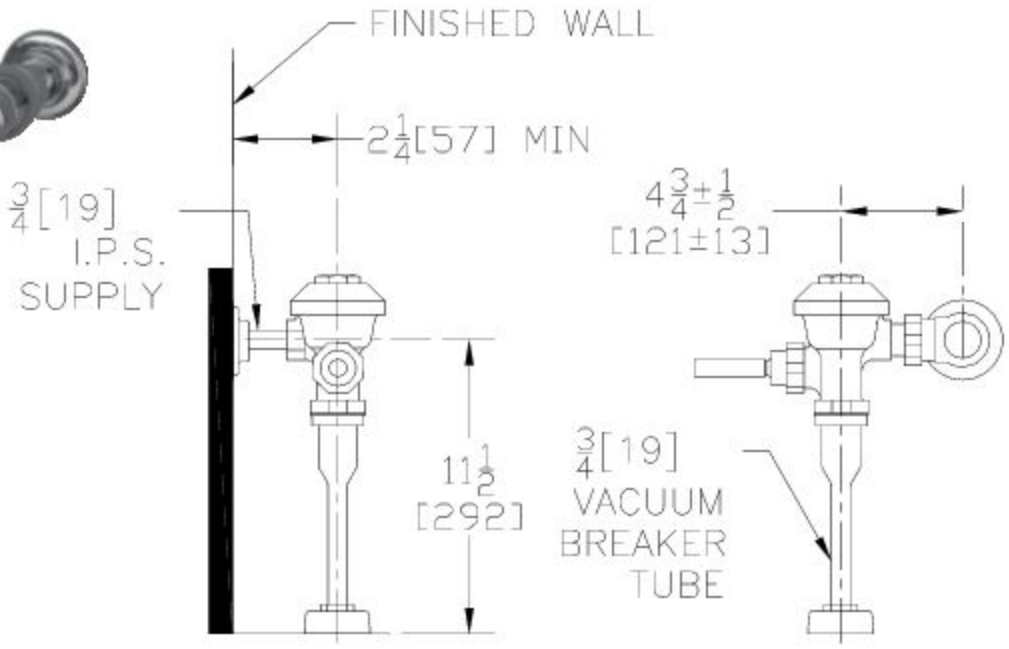
TAG _____

Z6003PL-ULF

0.125 GPF High Efficiency Valve for use with 0.125 GPF Ultra Low Flow 3/4" Urinals

9754411







Suffix Options (Check/Specify Appropriate Options)

_____	**-BG**	BioCare Handle
_____	**-H**	Handle on Front of Flush Valve
_____	**-L**	1" [25] Metal Push Button
_____	**-L3**	3" [76] Metal Push Button
_____	**-YJ**	Split Ring Pipe Support
_____	**-YK**	Solid Ring Pipe Support
_____		Other

ENGINEERING SPECIFICATION: ZURN Z6003PL-ULF AquaSense® Exposed Urinal Flush Valve- Exposed, quiet diaphragm-type, chrome plated .125 GPF flushometer valve with a polished exterior. Complete with Zurn's AquaVantage® TPE, chloramine resistant, dual seal diaphragm with a clog resistant, filtered by-pass. The valve is ADA compliant with a non-hold open and no leak handle feature, high back pressure vacuum breaker, one piece hex coupling nut, adjustable tail-piece, spud coupling and flange for top spud connection. Control stop has internal siphon-guard protection, vandal resistant stop cap, sweat solder kit, and a cast wall flange with set screw. Internal seals are made of chloramine resistant materials.

This space is for Architectural/Engineering Approval

The information contained in this document is subject to change without notice.
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In Canada: ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2 ♦ Phone: 905-405-8272 Fax: 905-405-1292

AquaSense® is a registered trademark of Zurn Industries, LLC.

Rev.
Dwg. No. 200393

Date:
Product No. Z6003

Seats

BEMIS COMMERCIAL

COMMERCIAL HEAVY-DUTY PLASTIC TOILET SEAT



MODEL # **COLOR #**

1955CT/1955SSCT _____

DESCRIPTION:

Open front less cover, elongated, heavy-duty, injection molded solid plastic toilet seat. Features four molded-in bumpers, non self-sustaining (1955CT) or self-sustaining (1955SSCT) check hinges with non-corrosive 300 Series stainless steel posts and pintles and STA-TITE® Commercial Fastening System™. This seat complies with IAPMO/ANSI Z124.5-2013 Plastic Toilet Seats as a class Commercial Heavy Duty.

783993

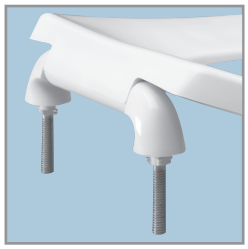
SPECIFICATIONS:

Size:	Elongated
Material:	Plastic
Style:	Open Front less Cover
Bumpers:	Four
Hinges:	Plastic Non Self-Sustaining (1955CT) or Self-Sustaining (1955SSCT) with 300 Series Stainless Steel Posts and Pintles
Fastening System:	STA-TITE® Commercial Fastening System™

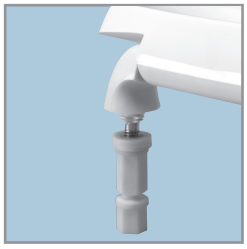
FEATURES:

STA-TITE® Commercial Fastening System™

Non-Corrosive 300 Series Stainless Steel Posts and Pintles

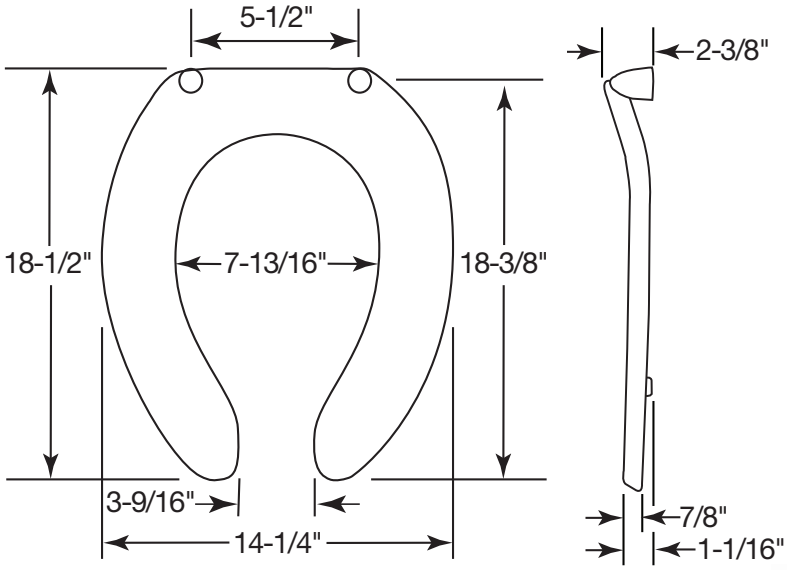


PLASTIC HINGES WITH STAINLESS STEEL POSTS AND PINTLES



STA-TITE® COMMERCIAL FASTENING SYSTEM™

DIMENSIONS:



Proudly Made in the USA

Bemis Manufacturing Co., Sheboygan Falls, WI 53085
www.ToiletSeats.com
Phone: 800-558-7651 Fax: 800-292-3647

Faucet Restrictors

PCA® Spray
Faucet Attachment - 0.5 gpm max
Pressure Compensating **Regular Size**

NEOPERL®
flow, stop and go®

1530559

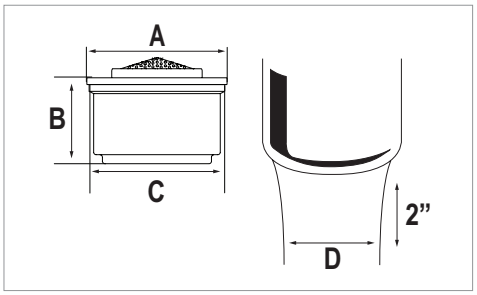
Features and Benefits

- Watercolours® design: Color coding to identify flow rate and stream pattern.
- Provides a non-splashing, non-aerated spray
- Pressure compensating for constant flow from 20 to 80 psi.
- Anti-clogging dome screen filters sediment and particles.
- Also compatible with regular and vandal proof M22 and M24 metric housings.
- Available housing finishes: chrome, polished brass, brushed nickel and oil rubbed bronze.
- Laser marked housings with statutory marks.









Certifications

ANSI/NSF®-61-372
ASME A112.18.1M and CSA B125 (pending)
Meets CALGreen requirements

Thread & Part Number

Part #	Designation	Thread Size
10 235	Insert only	
10 200	Regular male	15/16”-27
10 210	Regular female	55/64”-27
10 220	Regular dual thread	15/16”-27 x 55/64”-27
10 204	Vandal proof regular male	15/16”-27
10 214	Vandal proof regular female	55/64”-27
10 226	Vandal proof regular dual thread	15/16”-27 x 55/64”-27

Other product combinations available.

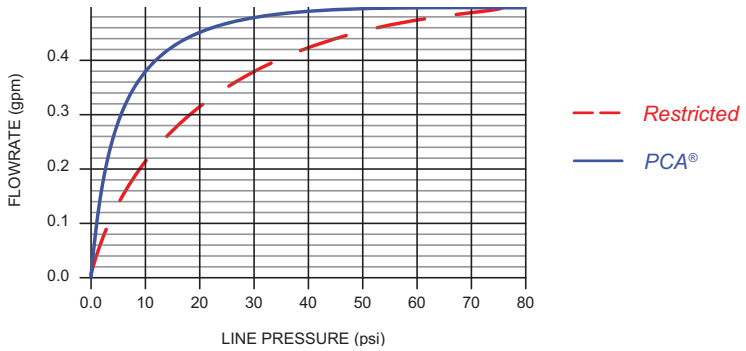
Packaging:

Inserts	*1pc (bag), 6pcs (tube), 50pcs (bag)*
Reg. male/female/dual thread	*1pc (bag), 6pcs (tube), 50pcs (tray)*
Reg. vandal proof male/female/dual thread	*1pc (bag), 6pcs (tube), 50pcs (tray)*

Color Code

Dome	Flow Regulator	Basket
Clear	Lime Green	Light Gray

Flow Rate Curve



Dimensions

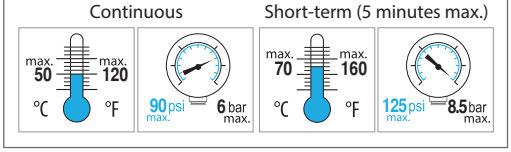
No	mm	In
A	20.85	.821
B	13.00	.512
C	19.95	.785
D	≈ 25	≈ 1

Housings



Technical Data

Materials:	Body	Acetal
	O-ring	EPDM
	Washer	EPDM



NEOPERL, Inc., Waterbury, CT • Tel: 203-756-8437 • Fax: 203-574-2107 • www.neoperl.com

LFFA-7

PCA® Spray
Faucet Attachment - 1.0 gpm max
Pressure Compensating **Regular Size**

NEOPERL®
flow, stop and go®

1530559

Features and Benefits

- Watercolours® design: Color coding to identify flow rate and stream pattern.
- Provides a non-splashing, non-aerated spray.
- Pressure compensating for constant flow from 20 to 80 psi.
- Anti-clogging dome screen filters sediment and particles.
- Also compatible with regular and vandal proof M22 and M24 metric housings.
- Available housing finishes: chrome, polished brass, brushed nickel and oil rubbed bronze.
- Laser marked housings with statutory marks.







Certifications

ANSI/NSF®-61-372
ASME A112.18.1M and CSA B125
Meets CALGreen requirements
WaterSense

Thread & Part Number

Part #	Designation	Thread Size
10 735	Insert only	
10 700	Regular male	15/16"-27
10 710	Regular female	55/64"-27
10 720	Regular dual thread	15/16"-27 x 55/64"-27
10 704	Vandal proof regular male	15/16"-27
10 714	Vandal proof regular female	55/64"-27
10 726	Vandal proof regular dual thread	15/16"-27 x 55/64"-27

Other product combinations available.

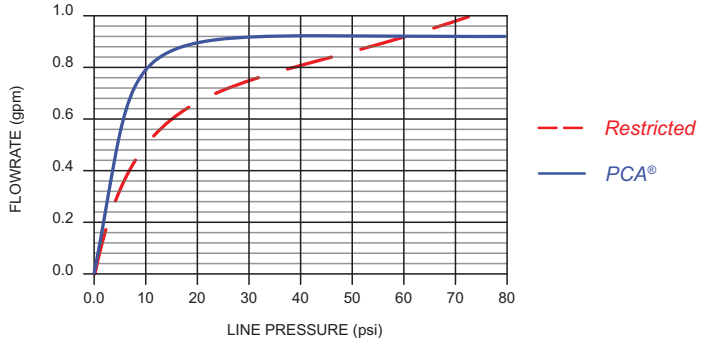
Packaging:

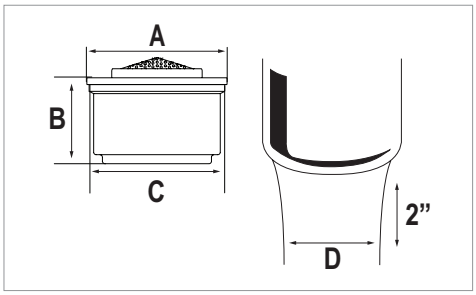
Inserts	*1pc (bag), 6pcs (tube), 50pcs (bag)*
Reg. male/female/dual thread	*1pc (bag), 6pcs (tube), 50pcs (tray)*
Reg. vandal proof male/female/dual thread	*1pc (bag), 6pcs (tube), 40pcs (tray)*

Color Code

Dome	Flow Regulator	Basket
White	Blue	Dark Gray

Flow Rate Curve





Dimensions

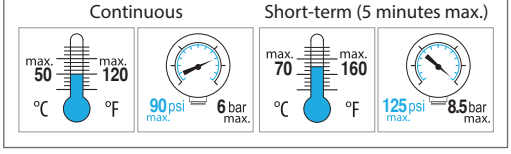
No	mm	In
A	20.85	.821
B	13.00	.512
C	19.95	.785
D	≈ 25	≈ 1

Housings



Technical Data

Materials:	Body	Acetal
	O-ring	EPDM
	Washer	EPDM



Pre-Rinse Sprayer

T&S BRASS AND BRONZE WORKS, INC.
2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

Model No.
B-0107

Item No.

This Space for Architect/Engineer Approval

Job Name_____Date_____

Model Specified_____ Quantity_____

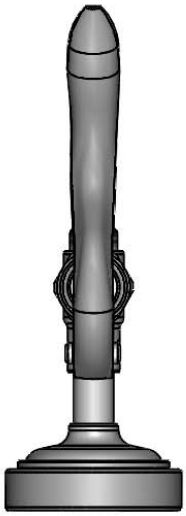
Customer/Wholesaler_____

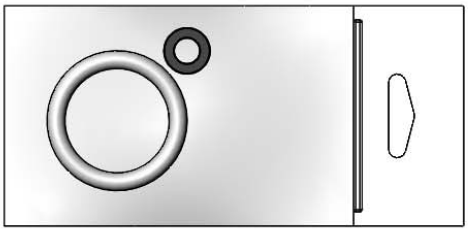
Contractor_____

Architect/Engineer_____

8297

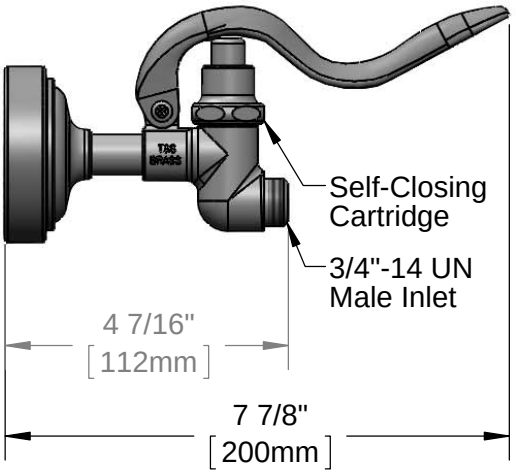






Hose Washer &
Hold Down Ring
(Included)





Product Specifications:
Pre-Rinse Self-Closing Spray Valve w/ Rubber Bumper
& 1.42 GPM Flow Control Spray Face

Product Compliance:

ASME A112.18.1 / CSA B125.1
NSF 61 - Section 9
NSF 372 (Low Lead Content)
EPAct 2005 (PRSV)

Drawn:	KJG	Checked:	JRM	Approved:	JHB	Date:	03/14/14	Scale:	1:3	Sheet:	1

T&S BRASS AND BRONZE WORKS, INC.
2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690

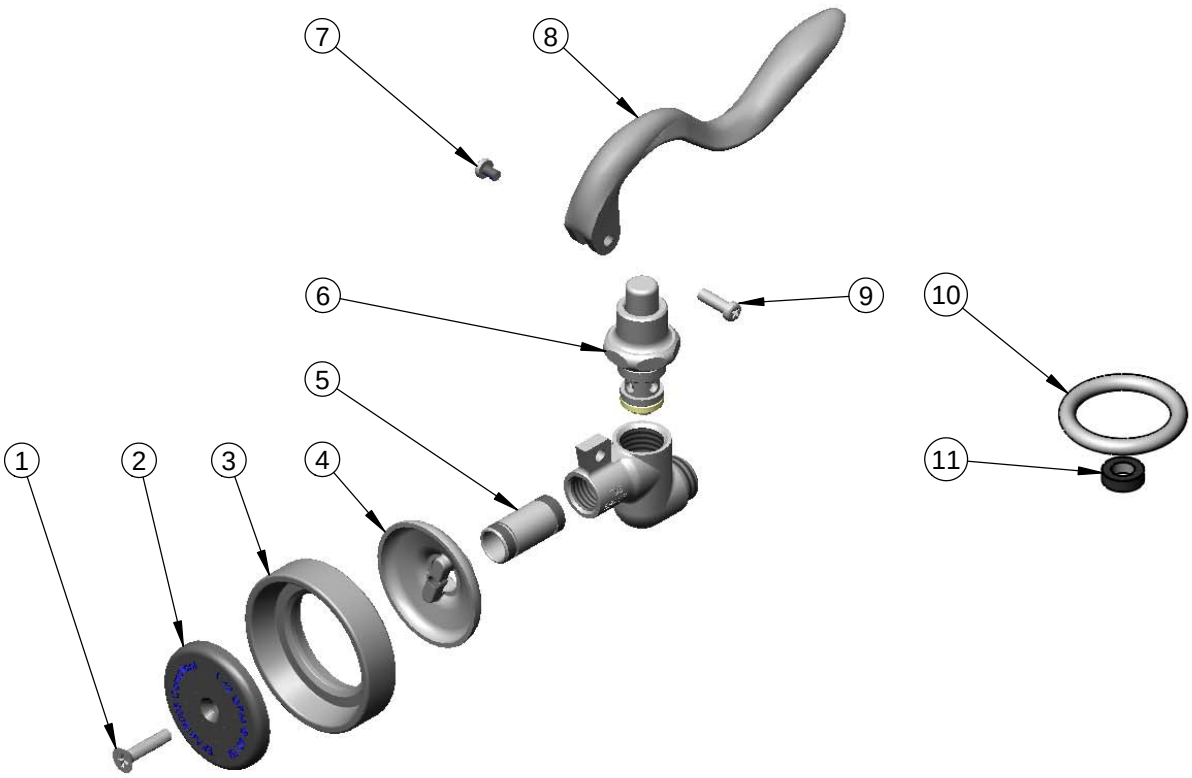
Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

Model No.
B-0107

Item No.

ITEM NO.	SALES NO.	DESCRIPTION
1	000913-45	Screw
2	001121-45	Spray Valve Spray Face
3	007861-45	Spray Valve Sprayhead Ring
4	000019-40	Spray Valve Spray Cup
5	000694-40	Spray Valve Short Nipple, Plated
6	002856-40	Spray Valve Bonnet
7	003199-45	Spray Valve Handle Screw
8	001120-45	Spray Valve Handle
9	003198-45	Spray Valve Handle Nut
10	000907-45	Spray Valve Hold Down Ring
11	010476-45	#27 Washer

8297



Product Specifications:
Pre-Rinse Self-Closing Spray Valve w/ Rubber Bumper
& 1.42 GPM Flow Control Spray Face

Product Compliance:

ASME A112.18.1 / CSA B125.1
NSF 61 - Section 9
NSF 372 (Low Lead Content)
EPAct 2005 (PRSV)

Drawn:	KJG	Checked:	JRM	Approved:	JHB	Date:	03/14/14	Scale:	NTS	Sheet:	2

Peerless GSH5/GDH5

Single Hung/Double Hung
Tilt Thermal Aluminum Window

AW-PG50-H/ AW-PG50-H

PRODUCT FEATURES

Frame depth
4-1/4"

Typical wall thickness
.080"

Thermal break design
Polyamide strut

Maximum glass thickness
1-3/8"

Ext./Int. glazing material
Santoprene/Santoprene

U Value
GSH5 0.28 / GDH5 0.229



Designed for Beauty and Performance

Beauty, flexibility and superior performance is designed into every Peerless Hung window system. The Peerless GSH5 Single Hung and GDH5 Double Hung window series offers the maximum in Energy Efficiency. The corners of the frame are mitered with no exposed edges for a clean architectural design. The ENERGSAVE Series allows for multiple units to be built into one master frame for ease of installation. The Peerless ENERGSAVE Hung series is ideal for a variety of different markets including— Education, Office, Multi-Family, Healthcare, Hospitality and Government markets.

Energy Innovation from the Heartland of America

Peerless
ARCHITECTURAL WINDOWS & DOORS

ENERGSAVE

Peerless GSH5/GDH5

Single Hung/Double Hung Tilt Thermal Aluminum Window

AW-PG50-H/ AW-PG50-H

BENEFITS

ARCHITECT

Energy Savings

Single Hung

- U Value of 0.28 below national standard
- CRF above 65 ensures reduced condensation

Double Hung

- Unique 0.229 U Value for AW double hung tilt
- CRF above 62 ensures reduced condensation

Third Party Certifications

- AAMA – certified window for performance
- IGCC – certified insulating glass for long life

Design Flexibility

- Unique frame design allows for multiple selection of glass types to meet low U values

Finish and Color Choices

- Exterior and interior colors can be different
- Standard or anodize paint colors

BUILDING OWNER

Building Security

- Automatic sill locks engage when closing
- Unique tilt latch design resist tampering

Low Maintenance

- Tested to AAMA 'Life Cycle' specifications
- Class 5 balances for many years of operation

INSTALLER

Frame Choices

- Continuous head/sill/jamb eliminate mullions
- Flange designs can eliminate field trimming

Field Labor Reductions

- Easy-to-remove glass film keeps glass clean
- Dry exterior gaskets ensures interior reglazing



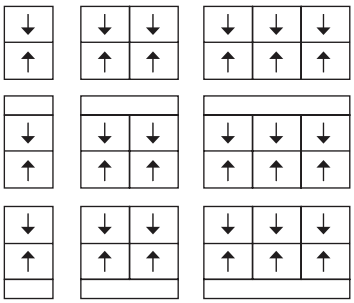
Single Hung
(Shown)

CERTIFICATION	GSH5/GDH5
AAMA standard/specification	A440-08
Minimum test size	60" x 99"
Air infiltration rate @6.24 psf	.03 cfm/sq.sf
Water test pressure	10 psf
Structural load test pressure	75 psf
* U Value (Single Hung)/(Double Hung)	0.28/0.229

*Test glass – 1/4" soft Low E x Argon x 1/4"

TYPICAL CONFIGURATIONS

Double Hung shown, Single Hung – top sash is fixed



Energy Innovation from the Heartland of America

Peerless
ARCHITECTURAL WINDOWS & DOORS

Peerless Architectural Windows and Doors, 2403 S. Main, Fort Scott, KS 66701
Phone: 620-223-4610 • www.Peerless-USA.com

#112613
3D/R5-22-15

APPENDIX 4 SAFETY MANAGEMENT PLAN

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HSE Safety Management Plan

Prepared by:	Paddy Phelan
Signature:	
Date:	12/11/18
HSE Manager:	Sharon Arents
Signature:	
Date:	
Customer:	Morris County School of Technology
Signature:	
Date:	

NOTE: A SIGNED AND ACCEPTED COPY IS TO BE KEPT ON SITE AND ON CONTRACT FILE.

INTRODUCTION

The Health, Safety & Environmental (HSE) Site Management Plan is an integral part of all work and site specific procedures for all Honeywell operations. Honeywell is committed to developing safety systems which ensure the highest standard of health and safety for all employees. We aim to continually improve the systems of work and strive for best practice in the area of health, safety and environment. Honeywell aims to control risk through the implementation of an effective HSE Site Management Plan and Program.

The objective of this document is to establish a plan for implementing the company safe operations management program. The plan is intended to minimize losses, meet regulatory compliance requirements and to implement site health, safety and environmental regulations established by the Customer.

Honeywell demonstrates its commitment to health and safety by making all levels of management accountable for all health and safety issues. We attribute the success of effective safety systems to the ability to communicate the agreed standards of performance between employees and management. Honeywell's commitment to health, safety and the environment can be viewed at **Attachment 1: Honeywell HSE Commitment Statements**.

1. Plan Deployment

The HSE Plan is one component of Honeywell's Safe Operations Management (SOM) program. The HSE Plan, and its relevant components and references specific to this project, should be reviewed with the Customer, Honeywell representatives and subcontractors/contractors to ensure effective deployment of the SOM program. This includes:

(1) On-site meeting between Customer and Honeywell representative(s) and subcontractors.
(2) Customer and Honeywell representative(s) and subcontractors are briefed and understand the Safety Management Plan:
    a) Site information,
    b) Hazard and risk assessments,
    c) HSE training,
    d) Activity schedules,
    e) Measures of HSE performance.
(3) Plan is to be reviewed on a quarterly basis to ensure Management of Change.
(4) Plan shall be maintained to ensure that relevant information is available to employees, contractors, customers, clients and the public concerning the effects of the Company's activities and materials on the safety and health of people and impact on the environment.
(5) Communication and management systems shall be developed, implemented and maintained throughout each site to facilitate continuous improvement in performance.

(6) Active consultation and communication with employees and contractors in the improvement of health, safety and environmental work.

Honeywell Management Systems are the property of Honeywell and must be maintained in accordance with Honeywell Information Security guidelines. Clients wishing to view any components of the Honeywell Operating System (external to Safe Operations Management) can request to do so by contacting the Honeywell Project Manager, who will assess the request and where deemed appropriate, arrange for viewing of the relevant Honeywell information.

2. Revision Sheet

When changes are made to this document, the revision sheet must be revised and all controlled copies of the document updated and distributed per the Distribution List.

Revision	Date	Description
Initial Draft	12/11/18	Initial document

3. Distribution List

One hard copy will be maintained for the assigned contract on site. Electronic copy can be distributed, upon request.

Copy	Name	Organization & Title	Email Address
1	Paddy Phelan	Honeywell Project Manager	Padraic.Phelan@honeywell.com
2	Sharon Arents	Honeywell HSE Leader	Sharon.Arents@Honeywell.com
3	Bob Letso	Honeywell PM Leader	Robert.letso@Honeywell.com
4		Customer Project Manager	
5		Customer HSE Leader	

4. Contents

Introduction
Section 1 Site Information
Section 2 Site Hazards and Safety Management Plan
Section 3 Site Requirements
Section 4 Site HSE Activity Schedule
Section 5 Site HSE Performance
Section 6 Contract Form and Attachments

SECTION 1 – SITE INFORMATION & HSE ADMINISTRATION

5. Contract – Scope of Work Description

Project name:	Morris County School of Technology
Customer name and address:	Morris County School of Technology - 400 E Main St, Denville, NJ 07834
Scope of work (summary):	Lighting, Controls, Building Envelope, Windows, Transformers,
Start Date:	TBD
Completion Date:	TBD

6. Key Project Contacts (List all Honeywell Employees & Contractors)

Honeywell Project Manager	Paddy Phelan	516-448-8645 Padraic.Phelan@honeywell.com
Honeywell Project Administrator		
Honeywell Branch Project Manager		
Honeywell Regional HSE Leader	Sharon Arents	Sharon.Arents@Honeywell.com
Customer Project Manager		
Customer HSE Leader		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		
Subcontractor Project Manager		

7. Customer HSE Reporting

Honeywell will report HSE performance to the Customer, if required, as defined in the scope of work and/or contract. Reporting topics may include:

- Customer requested HSE metrics at customer request,
- Incidents/injuries, Safety Observation System events,
- Summary of HSE Project Manager site reviews/audits, Contractor audit results

8. Cardinal Rules – Unacceptable Behaviors & Attitudes

The Cardinal Rules shall be displayed at all Honeywell locations, including field offices and also at designated Honeywell offices within the Customer site. All employees are to adhere to the Cardinal Rules which can be viewed at **Attachment 2: Honeywell Cardinal Rules**.

9. Responsibilities, Authority & Resources

Management & Resources

The Honeywell Project Manager is responsible for the implementation of the Honeywell Health, Safety and Environment Plan requirements and shall maintain and monitor programs aimed at continuous improvement of HSE performance. Appropriate health, safety and environmental support and resources shall be available to assist project and service managers to discharge their responsibilities.

Honeywell Project Manager Responsibilities

Each PM is accountable for implementation of Honeywell's HSE Policy. Specific responsibilities are:

- Supports and promotes jobsite safety through leadership and example.
- Becomes involved in task safety analysis in order to identify any hazards and manage the associated risks prior to work being done.
- Ensures the completion of job hazard analysis prior to the beginning of any work including review and approval.
- Insist upon employee's and subcontractor's compliance with established safety rules, correcting any unsafe acts or conditions, and implementing corrective or disciplinary actions as necessary for the effective functioning of the safety program.
- Ensure all team members are trained in safe work procedures.
- Ensure regular hazard inspections are carried out within areas under their control.
- Verify that employees and subcontractors implement the designated site safe work procedures/systems.
- Ensure approved Honeywell employee protective equipment is issued and proper instruction given as to its use, maintenance and storage.
- Be involved in formal as well as informal safety audits and monitor contractor and site safety performance on a regular basis.
- Ensure that all accidents and injuries are reported and investigated.
- Identify cause of non-compliance and investigate/document actions to correct safe work method deficiencies or rectify inappropriate workplace behaviors, including consultation, counselling, training and/or disciplinary action.
- Preparation and regular review of work procedures.

All Honeywell Employee Responsibilities

Employees have a duty to cooperate in the achievement of a safe and accident free workplace, through:

- Cooperating in fulfilment of the obligations placed on Honeywell International.
- Identify all tasked and prepare risk assessments.
- Working with care for their own safety and that of others who may be affected by their actions
- Reporting unsafe conditions and behaviours.
- Wear and maintain any issued personal protective equipment (PPE) when necessary.
- Assisting in the investigation of any accidents with the objective to prevent recurrence.
- Maintain a safe working environment for all Honeywell/Contractor employees that may be utilized for this project.
- Report all safety issues or events directly to the Honeywell Project Manager.

Subcontractors shall be responsible for complying with all Subcontractor Responsibilities

Subcontractors shall be responsible for complying with all statutory obligations and shall exercise all possible care for the health and safety of their personnel and other persons at the workplace who may be affected by their activities. Subcontractors shall at all times comply with Honeywell's HSE policy and procedures. As a condition of employment all employees are expected to work in a safe and responsible manner. The employee is ultimately responsible for his or her own safety. All contractors shall provide the employee with all the necessary training and PPE, but the employee must make the proper choices when performing an assigned task. Any issues not covered by this Safety Plan should be communicated to the relevant Honeywell representative. The Contractor's personnel will have responsibilities, which include but may not be limited to the following:

- Establishing safety responsibilities for their site personnel including their subcontractors.
- Insisting and ensuring correct and safe practices are used at all times.
- Providing adequate resources, personnel, equipment, time and funds to ensure the objectives of the safety plan are met.
- Completing the required work authorization forms and safety permits for each activity.

- Following safety rules and verbal instructions. Ask superintendent questions when any uncertainty exists.
- Ensuring their site personnel are suitably trained to effectively carry out their HSE responsibilities.
- Using tools in a safe and appropriate manner in accordance with their design; inspecting them for damage prior to each use.
- Ensuring safety auditing and performance reporting requirements specified by Honeywell are met.
- Reporting any unsafe acts or conditions, correcting them whenever possible.
- Reporting all injuries, incidents and near misses immediately, no matter how minor.

Project Employee/Contractor List

The Honeywell Project Manager will maintain the **Attachment 3 Site Project Contractor/Employee List**. All Contractors and Honeywell Employees working on site, listed or not, have a duty to cooperate in the achievement of a safe and accident free workplace.

10. Site Facilities

Honeywell Designated Areas

All designated Honeywell areas, if any, at the customer site must be maintained by Honeywell staff to ensure these facilities are kept in a clean and hygienic condition for the duration of the contract. At a minimum, these areas are to be inspected weekly to identify any workplace hazards or risks and to ensure minimum standards are maintained. If there is a Honeywell office you are required to post the Honeywell Commitment Statement and Cardinal Safety Rules. Depending on local or federal requirements ensure regulatory postings are current.

Security

Honeywell employees must meet all customer security requirements. This may include visitor badges, access training, appropriate regulatory and/or customer documentation, background checks, registry upon arrival and departure, etc. Badges are to be worn above the waist and in a visible position at all times while on site.

11. Honeywell Staff Training

Training needs shall be identified and training delivered to ensure that the project and service managers have the appropriate health, safety and environmental management skills. Honeywell employees shall be instructed in safe systems of work to ensure they work with proper regard for the safety, health, and protection of themselves, others and the environment. The Honeywell Project Manager is responsible for identifying the specific training requirements of their team members and ensuring the required training is undertaken. This training may be either Honeywell internal training, or training specific to the project location provided by the customer, provided the minimum content requirements are met. The minimum required training for the project scope of work is listed in Section 3 of this safety management plan.

12. Contractor Work Authorization & Permits

Contractor Sign-in & Work Authorization

Contractors must complete the Contractor Safety Declaration and Work Authorization Form with required risk assessments and permits prior to commencing work. Low risk work can be undertaken by contractors without direct authorization given that the relevant Honeywell Project Manager is aware of the:

1) Scope of work.
2) Time the work is to be undertaken.
3) Workers performing the work.

Attachment 4: Contractor Safety Declaration & Work Authorization Form
Attachment 5: Safety Permit Applications

13. Accident / Incident Events

Reporting of Accident / Incident Events

Honeywell Employees & Contractors must adhere to the following reporting requirements,

(1) Globally contact the Honeywell Project Manager
(2) Honeywell employees only - Call the HSE Hotline at 1-866-466-1765
(3) Honeywell Project Manager will contact the customer safety manager if required.
(4) The Honeywell HSE Manager must be contacted should any of these events occur.
    a. All injuries and incident events
    b. Release of dangerous goods or hazardous substances to the environment
(5) Certain incidents must also be reported to the relevant local workplace safety or environmental

protection authorities in accordance with local legislation.

Incident Investigation of Accident / Incident Events

Honeywell Representative must follow the following criteria after an accident or incident occurs.

(1) Conduct an incident investigation in accordance with Honeywell injury and incident investigation requirements in consultation with the regional HSE manager and affected employee(s).
(2) Ensure implementation and close out of short and/or long-term corrective actions to prevent re-occurrence.
(3) Present to Honeywell Project Management Leader and HSE Manager all planned corrective actions.

Attachment 6: Incident Investigation Report

14. Safety Observation System Events

Safety Observations must be submitted to the Honeywell Project Manager by any Honeywell employee using the **Attachment 7 Safety Observation Form**. Safety Observation is an unplanned event or condition that could have reasonably resulted in personal injury or illness, equipment or property damage, an environmental excursion, or when a safety control measure is challenged or ignored.

15. Site Evacuation Procedures

The Honeywell site specific **Emergency Response Plan, Attachment 17** shall be prepared, if a customer equivalent response plan is not available. The Honeywell Project Manager shall review and incorporate the emergency response plan into the Safety Management Plan. Either the Honeywell or Customer site specific emergency response plan shall be followed and this plan shall be communicated to all Honeywell employees, contractors, and visitors prior to working at the project site. For any Honeywell-occupied spaces such as a job trailer, leased office space or warehouse used during the course of a project, Honeywell shall complete a Honeywell site specific Emergency Risk Assessment by checking the appropriate boxes, then complete a site specific Emergency Response Plan as explained in the Emergency Response Procedure.

SECTION 2 – SITE RISK ASSESSMENT TOOLS

16. Hazard Reporting

It is the responsibility of all employees to immediately report any unsafe act or condition to the Honeywell Project Manager. Honeywell actively encourages all employees and contractors to report hazards. The strength of our Health, Safety Management Plan relies on the ability of Honeywell employees and contractors to report hazards. At each site, all hazards that are identified by employees or contractors shall be communicated immediately to the Honeywell Project Manager. In the event that the hazard is considered significant, it must be reported immediately to the appropriate Customer representative.

17. Site Assessment Tools

Identify Site Hazards

Hazards associated with contracted scope of work shall be identified and documented in the **Attachment 8 hazard assessment site inventory**. The Hazard Assessment Site Inventory should include all identified hazards for the scope of work on this contract. The Hazard Assessment is used to prepare task and generic risk assessments or contractor authorizations.

Risk Assessment & Contractor Work Authorization Forms

Each hazard must be assessed according to the risk calculator listed on the **Attachment 9 Risk Assessment Form** to ensure the hazards are categorized as low, medium or high risks. Risk exposure to hazards in the work environment is determined by consequence and severity resulting in a low, medium or high risk level. **[**Click **HERE** for sample Risk Assessments / Safe Work Procedures.**]**

Risk assessments and contractor work authorization forms include a list of control measures which need to be developed and made readily available for the duration of the work. Hazards shall be controlled to ensure that consequent risks are eliminated or reduced as far as is reasonably practicable. Control measures shall be reviewed and monitored for their effectiveness. Continuous consultation should occur with all employees and contractors on site to ensure that hazards are identified and controls implemented.

Control measures will be selected in accordance with both established Field Risk Assessment Forms and the “Hierarchy of Control Measures” aimed at eliminating the hazard or hazardous activity. The most desirable

control measure must be selected using the control hierarchy, in this order, elimination, substitution, engineering control, administrative control and personal protective equipment.

Tasks assessed as a high risk will require notifying the Honeywell Project Manager prior to commencement of work. The Honeywell Project Manager will evaluate the task for personal safety issues. All relevant activity check sheets and permits shall be completed in advance, and applicable guidelines, procedures, and/or work instructions will be reviewed and followed prior to and during the performance of the tasks.

Both contract and site specific data should be reviewed for inclusion in the orientation process to ensure key hazards/risks and any expectations in relation to the hazard elimination/risk management are communicated to the relevant employees and contractors.

The Honeywell Project Manager shall ensure that risk assessment and contractor authorization forms are implemented where required and ensure a quality standard of service is provided. Honeywell has developed a list of safety procedures for site work that facilitate compliance to legislative requirements. After the contractor completes the work authorization form the contractor may use previously completed Honeywell and/or the customer field risk assessment forms, provided that the contractor understands the procedure and takes ownership of the field risk assessment forms. All field risk assessment forms need to be reviewed by each employee prior to commencement of work.

Field Risk Assessment Forms identified are assessed for any potential risks of personal injury or injury to others, and property damage or environmental damage. Risk Assessments are separated into generic and task specific functions. The following are only examples and do not include all tasks that may apply at the customer or Honeywell location,

- Generic Field Risk Assessment Forms include common steps that are prepared once and can be used at multiple locations,
  - Climbing a ladder, working from a scaffold, scissor lifts, aerial lifts, man lift, etc.
  - Safe driving to/from customer locations
  - Personnel safety at customer locations, including walking on site
  - Roof Work
  - Mobilization of personnel, equipment or heavy components
  - Working on operating equipment
- Task Specific Field Risk Assessment Forms are prepared for a unique task at the customer site,
  - Equipment specific Lock Out / Tag Out, of electrical, mechanical, hydraulic, pneumatic, gravity, gas tie-ins, refrigerant servicing, etc.
  - Working from heights involving fall protection
  - Demolition of Electrical Cabling, equipment, etc.
  - Working in areas (e.g., installation, demolition) with live power or active control / fiber-optic cable, including junction boxes, where there is a substantial possibility of interrupting a live circuit.

18. Site Specific Field Risk Assessment Form Inventory

The Project Manager is responsible for keeping an inventory of the completed risk assessments and contractor work authorizations for the scope of work of this contract using the table provided in the hazard assessment site survey Attachment 8. This includes specific Field Risk Assessment Forms identified as a result of the completed Risk Assessments and Contractor Work Authorization Forms. All contract personnel are required to be familiar with the procedures and when they are to be used. These procedures must be followed at all times when the identified major risk activity is performed. Full records are to be kept for every major risk activity performed.

SECTION 3 – Site Requirements, HSE Training, Licenses and Competency

19. Customer Site Orientation

General Requirements

All Honeywell employees and contractors working on the customers sites will complete the customer site orientation, if required by the customer. Honeywell contractor orientations shall be managed by the Honeywell Project Manager to ensure that all orientations, including site safety management plan requirements are received and accepted by contractors and Honeywell staff, documented as being completed, and maintained in this plan for all contract personnel as required by Honeywell.

Orientation Schedule

The following orientations must be completed:

Orientation	Orientation Frequency	Key Contact(s)
Contractor Orientation	Prior to commencement of work. Complete **Site Orientation Form Attachment 10** with contractors & their employees Prior to commencement of work. Complete **Attachment 12 Field Safety Checklist** which document potential hazards. Review Contractor Work Authorization Forms with required safety permits.	Jim Shearman
Honeywell Employee Orientation	1. Prior to commencement of work and annually. Complete required monthly training modules per **Attachment 11 Training Register**. 2. Document employee having completed Risk Assessment Forms with required safety permits.	Jim Shearman

20. HSE Training, Licenses & Certificate of Competency

Honeywell Staff, Contractors and Sub-contractors

Both Honeywell Staff and contractors are required to complete the Attachment 11 Training Register as proof of completion of the required training. Honeywell employees are required to complete **Attachment 15 Vehicle, Tool, & PPE Inspection Checklist**. Additional training requirements may be required by local regulations. If applicable, this must be verified as completed before commencing work at the site. Training must be completed prior to performing site specific task or activities. All contractors and Honeywell employees are required to be currently licensed in accordance with state and local requirements to perform the work and activities associated with the contract scope of work.

SECTION 4 – Site HSE Activity Schedule

21. Honeywell Project Manager HSE Activity Schedule

1) Conduct Safety Inspections:
    a) Attachment 12 Field Safety Checklist – Project Manager to complete prior to starting work onsite and annually.
    b) **Attachment 13 Behavioural Observation Checklist** – Project Manager to complete periodically to assess Honeywell field employees during scheduled construction.
    c) **Attachment 14 Contractor Safety Checklist** – Project Manager to complete periodically to assess Contractor safety compliance.
2) Attend Customer safety meetings and audits, as scheduled.
3) Report Safety Observations to the HSE Manager and Customer.
4) Document and approve all Risk Assessments, Contractor Work Authorizations and required safety permits.

SECTION 5 – Site HSE Performance

22. HSE Metrics

The following HSE metrics will be documented and maintained during project construction,

- Attendance at weekly contractor safety meetings.
- Number of safety audits performed and completed.
- Number (and %) of safety audit items in conformance with requirements.
- Number and types of injuries, illnesses, and safety observation events noted during the project.

SECTION 6 – Contract Forms and Tools

23. Contract Forms and Tools

Contracts Forms, Tools and Procedures

The following list includes all pertinent safety forms for the use of initiating and maintaining safe work practices as described in this Safety Management Plan. These forms are also included in the following pages of this section.

Attachment No.	Document Name	Time to Complete:	Frequency	Responsible to Complete
–	Safety Management Plan (SMP)	Start of contract	Once for each phase/contract	Honeywell PM
1	HSE Commitment Statements	Start of contract	Once with SMP	Honeywell PM (Post on-site)
2	HSE Cardinal Rules	Start of contract	Once with SMP	Honeywell PM (Post on-site)
3	Site Employee/Contractor list	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell PM
4	Contractor Work Authorization Form	Booking Date – Before Installation	Update as needed throughout project duration	All Subcontractors
5	Safety Permit Applications	Before performing task that requires it.	As required throughout installation	Contractor / Honeywell Field Employees
6	Incident Investigation Report Form	Within 24 hours of incident.	As required throughout project duration	Honeywell PM
7	Safety Observation Form	Throughout Project Duration	Monthly	All Honeywell Employees
8	Hazard Assessment Site Inventory	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell PM
9	Risk Assessment Form	Booking Date – Before Installation	Update as needed throughout project duration	Honeywell Field Employees
10	Site Orientation Form	Booking Date – Before Installation	Once with SMP	Honeywell PM
11	Training Register	Booking Date – Before Installation	Once with SMP	Honeywell PM
12	Field Safety Checklist	Booking Date – Before Installation	Done once for each trade, Update as needed throughout project duration	Honeywell PM
13	Behavioral Observation Checklist	Throughout installation	Monthly while Honeywell field employees are working	Honeywell PM
14	Contractor Safety Checklist	Throughout installation	Monthly while subcontractors are working	Honeywell PM
15	Vehicle, Tool, & PPE Inspection Checklist	Throughout project duration	Quarterly	Honeywell PM/Employees
16	Site Specific Emergency Plan	Booking Date – Before Install	Once with SMP	Honeywell PM

Sustainable Opportunity Policy
Honeywell's Commitment to Health, Safety and the Environment

By integrating health, safety and environmental considerations into all aspects of our business, we protect our employees, our communities and the environment, achieve sustainable growth and accelerated productivity, drive compliance with all applicable regulations and develop technologies that expand the sustainable capacity of our world. Our health, safety and environmental management systems reflect our values and help us meet our business objectives.

- We protect the safety and health of our employees, and minimize the environmental footprint of our operations through efforts to prevent illness, injury and pollution.
- We actively promote and develop opportunities for expanding sustainable capacity by increasing fuel efficiency, improving security and safety, and reducing emissions of harmful pollutants.
- We are committed to compliance with all of our health, safety, environmental and legal requirements everywhere we operate.
- Our commitment to health, safety and the environment is an integral aspect of our design of products, processes and services, and of the lifecycle management of our products.
- Our management systems apply a global standard that provides protection of both human health and the environment during normal and emergency situations.
- We identify, control and endeavor to reduce emissions, waste and inefficient use of resources and energy.
- We are open with stakeholders and work within our communities to advance laws, regulation and practices that safeguard the public.
- We abide by the company's own strict standards in cases where local laws are less stringent.
- Our senior leadership and individual employees are accountable for their role in meeting our commitments.
- We measure and periodically review our progress and strive for continuous improvement.

These are our commitments to health, safety, and the environment, and to creating Sustainable Opportunity everywhere we operate.

Dave Cote
Chairman and CEO

John Rajchert
President HBS
July 6, 2014

SMP Attachment 2: Honeywell Cardinal Rules

No Employee/Contractor may:

1. Engage in horseplay or conduct that endangers or injures employees, risks damage or actually does damage to company and/or customer property or the environment.
2. Bring into any company and/or customer site: firearms, explosives, or weapons of any type.
3. Bypass or operate equipment without guards, safety devices, or control equipment without following company and/or customer established procedures and protocols.
4. Disassemble, enter or perform servicing, changeover or maintenance on equipment without properly de-energizing and safeguarding all power sources according to the applicable lock-out/tag-out policy.
5. Violate a life safety permit procedure (confined space, hot work, line breaking and fall protection).
6. Knowingly place her/himself or another person in physical danger, conceal a safety hazard or unlawful chemical release to the environment, or fail to promptly obtain attention for a personal injury or chemical spill.
7. Possess or be under the influence of illegal drugs (not prescribed by a Physician of for their own use) or alcohol while on a customer site, company-owned and/or company-operated facility.

The actions listed above have been found to have such great potential for serious injury or damage that any employee that engages in such actions may be subject to discipline, up to and including termination from the company or removal from the project site, regardless of previous performance. This policy is intended to protect the employee and his/her co-workers.

All employees are expected to understand and adhere to these Cardinal Rules and to request assistance in questionable situations. Further, all employees are encouraged to question the safety and environmental performance of all operations and become involved in improving them.

Project Manager Signature: _____

SMP Attachment 3: Site Employee Contractor List

Badge #	Employer	Name	Phone Number	Supervisor

SMP Attachment 4: Contractor Safety Declaration & Work Authorization Form

Contractor Safety Declaration

As a duly authorized and designated representative and agent of _____ , hereafter called "Contractor/Subcontractor", I hereby certify and agree for myself and for and on behalf of Contractor /Subcontractor:

I have visited the project site _____ and visually inspected the general and local conditions which could affect the Contractor /Subcontractor Work. Any failure of the Contractor /Subcontractor to reasonably ascertain from a visual inspection of the site, the general and local conditions which could affect the Contractor /Subcontractor Work, will not relieve the Contractor/Subcontractor from its responsibility to properly complete the Contractor /Subcontractor Work without additional expense to Honeywell. In addition, I have read and agree to comply with all the Terms and Conditions as specified in the written contract.

1. I have already instructed or will immediately instruct all such agents and employees with respect to such conditions and/or hazards and the proper safety precautions to be observed in regard there to;

2. I certify that all necessary, adequate and operative protective clothing and equipment have been or will be immediately issued to all such agents and employees, together with full instructions and training for their use at Contractor's cost;

3. I certify that all Honeywell Safety and Work Specific procedures as specified in the Honeywell Contractors Safety Guide, including those addressing employee personal protective equipment (PPE), Life Critical Tasks and tool and equipment requirements will be put into effect; and that all such agents and employees will be properly supervised to insure compliance in the use of PPE, procedures and equipment and in the strict observance of safety rules and regulations;

4. I certify that all such agents and employees have completed the identified and required training and that proof of such training has been submitted to Honeywell representative. If such identified training has not been completed I agree to complete such training as identified and required to a standard equivalent or exceeding Honeywell standards.

5. I certify that I will participate in the Honeywell program to observe and monitor all such agents and employees for compliance to specified Safety Procedures and work practices as defined or required by any and all governmental regulations and laws.

6. At a minimum, I certify that Contractor /Subcontractor employees have been trained and/or briefed for the following applicable programs (identified with x), in accordance with local laws/regulations,

☐ General safety rules and regulations	☐ General protective clothing and equipment requirements
☐ Specific safety requirements	☐ Lockout and tagout
☐ Confined space entry	☐ Line breaking
☐ Eye and face protection	☐ Excavation
☐ Hearing protection	☐ Respiratory protection
☐ Burning, welding and cutting	x Honeywell Contractor HSE Guide
☐ Utility line hazards/precautions	_____
☐ Chemical line hazards/precautions	_____
☐ Workplace chemical hazards	_____
☐ other (specify)	

Date: _____ _____
Signature of Contractor's/Subcontractor's Representative

Date: _____ _____
Signature of Honeywell Representative

Honeywell Use Only: **HID #:**

PRELIMINARY SAFETY DETAILS								*Honeywell Use Only: Work Authorisation Form Expiry : (Max 12 months) HSE Signed:*
Site		Contractor		Phone				
Name (PM responsible for the work)			Job / PO / SR Number					
Names of other workers			Honeywell Project Manager					
Scope of Work			Project Duration					
Location of Work	Bloomfield, NJ							
1. Will you be using sub-contractors?	Yes □	No □	*You must inform the Honeywell Works Supervisor of all sub-contractors you intend to use.*					
2. Are all workers inducted to site & aware of first aid & emergency procedures?			Yes □	No □→	*If **No**, Do Not Proceed. Contact The Honeywell Project Manager*			
3. Are workers familiar with the work area and specific hazards in the work area(s)?			Yes □	No □→				
4. Are tools, plant and equipment in good order (plant maintained, electrical equip. tagged, etc)?	No Plant/Tools□		Yes □	No □→				
5. Are workers aware of the safety requirements for the job & licensed where required?			Yes □	No □→				

If the Scope of Works changes Honeywell must be contacted prior to undertaking the new works

HAZARD ID, RISK ASSESSMENT & CONTROLS

Identify the Hazards ✓ **applicable**	**Assess the Risk** ✓ **applicable**	When assessing risks use these risk levels:	Minor Potential for minor injury / first aid treatment Moderate Potential for lost time injury / medical treatment Major Potential for death or serious injury
		Detail Risk Control Measures to Be Used	**Responsible Person**
□ Exposure to live electrical circuit	**Major*** □	List controls to eliminate or minimize risks.	List who is responsible for ensuring the controls are in place and are
□ Fall > 1.8m	**Moderate*** □	Refer to relevant procedure or JSA.	
□ Line Breaking	**Minor** □		
□ Confined Space Entry			
□ Asbestos	** Detail Risk Controls & Responsibilities. Direct Authorisation required from the Honeywell Work Supervisor prior to commencing works.*		
□ Traffic / Mobile Plant			
□ Chemicals / Fumes / Dusts			
□ Noise / Vibration			
□ Public exposure to hazards			
□ Spill to Environment			
OTHER			

MANDATORY SAFETY PERMITS & SYSTEM ISOLATIONS
Safety Permits must be obtained and approved before commencing the following works. If not listed below use "other" section. (✓ applicable):

Other (not listed): List any Risk Control Safety permits not listed below here.

□ Hot Works	□ Live Electrical	□ Confined Space Access	□ Line Breaking	□ Roof/Ceiling Access	□ Equipment Isolation	□ Fire / EVAC Impairment	□ Penetration in fire rating material

6. Will the work cause interruption/isolation of site utilities (water, gas, electricity)?	No □	Yes □→	*If **Yes**, contact the Honeywell Works Supervisor*
7. Will you need to isolate systems or services (medical gas, UPS, security, comms, etc)?	No □	Yes □→	
If Yes to Q7 or Q8, what is the extent and impact of the isolation(s) / interruption?			

CONTRACTOR DECLARATION

I confirm that all necessary Health, Safety and Environment protection measures and precautions as detailed in this form will be taken to ensure the health and safety of workers and others who may be affected by the work. I also confirm the workers undertaking this work are competent, and where required, licensed to carry out the tasks.

Contractor Signature		**Date**	

SMP Attachment 5: Safety Permit Applications (Contractor & Honeywell Employee)

The permits listed below are required when called for by a risk assessment or contractor work authorization and must be documented and kept with the SMP. Permits not included or shown below may still be applicable, as determined by the Honeywell PM. Contractors may also use their own permits if approved and accepted by Honeywell PM.

Line Breaking, roof/ceiling access, Equipment Isolation, Fire/EVAC Impairment, Penetration in Fire Rated Material, Others

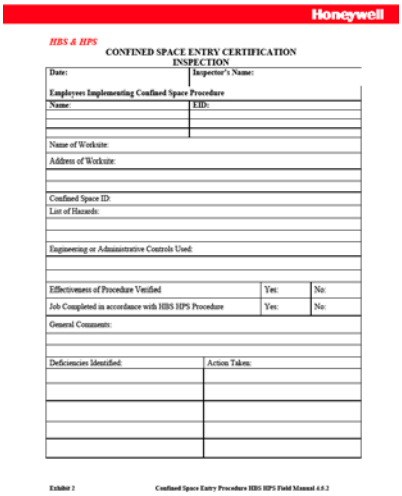
(Click on images below for PDF file attachment)

Hot Work Permit


HONEYWELL HOT WORK PERMIT

WARNING! HOT WORK IN PROGRESS WATCH FOR FIRE!

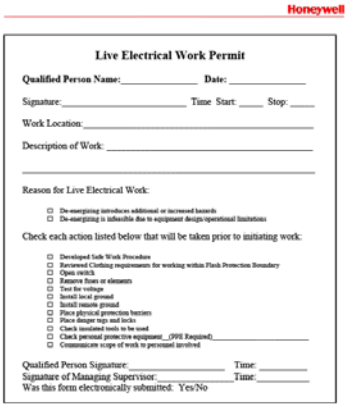
Confined Space Permit & Cert.


Honeywell

HBS & HPS

CONFINED SPACE ENTRY CERTIFICATION INSPECTION

Live Electrical Permit


Honeywell

Live Electrical Work Permit

Qualified Person Name:_____ Date: _____

Signature:_____ Time Start: ____ Stop: ____

Work Location:_____

Description of Work: _____

Reason for Live Electrical Work:

- ☐ De-energizing introduces additional or increased hazards
- ☐ De-energizing is infeasible due to equipment design/operational limitations

Check each action listed below that will be taken prior to initiating work:

- ☐ Developed Safe Work Procedure
- ☐ Reviewed Clothing requirements for working within Flash Protection Boundary
- ☐ Open switch
- ☐ Remove fuses or elements
- ☐ Test for voltage
- ☐ Install local ground
- ☐ Install remote ground
- ☐ Place physical protection barriers
- ☐ Place danger tags and locks
- ☐ Check insulated tools to be used
- ☐ Check personal protective equipment (PPE Required)_____
- ☐ Communicate scope of work to personnel involved

Qualified Person Signature:_____ Time: _____

Signature of Managing Supervisor:_____ Time:_____

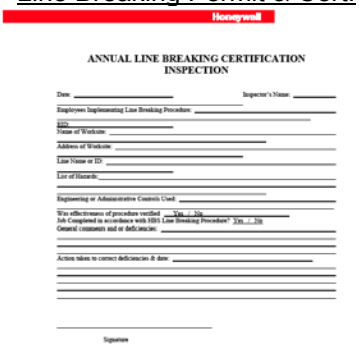
Was this form electronically submitted: Yes/No

Lockout/Tagout Permit


Honeywell

Multi Energy Source Equipment Specific Lockout\Tagout Procedure

Line Breaking Permit & Cert.


Honeywell

ANNUAL LINE BREAKING CERTIFICATION INSPECTION

SMP Attachment 6: Incident Investigation Report – Filed per Occurrence

Part 1: BASIC INFORMATION (Complete and return to HBS HSE Hotline within 24 hours)		
Name of person reporting (if not the Supervisor)	Date of report	
Name and address of location	Region/Business Site Code (LID)	Supervisor's name Supervisor's telephone number

Claimant / Accident Information			
Full Name of injured party Employee ID #	Address of injured party Home phone: Work phone:		Is the injured party ☐ Male ☐ Female
	Employee's typical work schedule:		
Date of Hire Job title Employment status	Days worked ☐ Mon ☐ Tue ☐ Wed ☐ Thu ☐ Fri ☐ Sat ☐ Sun	Time begins/ends to work	Contractor? ☐ Yes ☐ No If YES, please complete: Name and address of Temporary Agency/ Contractor: Contact: Phone number:

Date of accident Time of Accident ☐AM☐ PM	Employer notified on what date	Name of place where incident occurred Address where incident occurred	Was there lost time? ☐ Yes ☐ No If yes, Last day worked
Briefly describe the incident			
Were authorities contacted? (police, fire, ambulance) ☐ Yes ☐ No If YES, who		Was a report number given? ☐ Yes ☐ No If YES, list number	
Were any safeguards provided? ☐ Yes ☐ No Were they in use at the time of the incident? ☐ Yes ☐ No			
NATURE OF INCIDENT:			
TYPE OF INCIDENT:			
PART OF BODY:			

Medical Care Information	
Name and address of treating physician	Name and address of treating hospital/clinic
Phone number of treating physician	Phone number of treating hospital/clinic
Date employee first visited the doctor	What treatment was given (please check)
Describe diagnosis / medical treatment the doctor provided (List prescribed medications if any)	
Physical restrictions noted by the medical provider during the initial visit?	

Witness Information	
Name and address of a witness to the incident	Phone number where witness can be reached
Comments from witness N° 1	
Name and address of a witness to the incident	Phone number where witness can be reached
Comments from witness N° 2	
Anything related to the incident you would like to add	

Part 2: INCIDENT INVESTIGATION (Complete & return to the HBS Regional HSE Leader within 5 days)	
Root Cause Analysis	
Why did the incident happen? (Direct Cause)	
Why did this occur? (Contributing Cause)	
Why did that occur? (Contributing Cause)	
ADDITIONAL COMMENTS:	
PRIMARY ROOT CAUSE:	
SECONDARY/CONTRIBUTING ROOT CAUSE(S)	
Please explain or if additional information is meaningful, please describe:	

List corrective and preventative actions:

Corrective Action	Responsible Person	Target Date	Completion Date

SMP Attachment 7: Safety Observation Form

SAFE OBSERVATION SYSTEM (SOS) REPORT FORM

A SOS is an unplanned event or condition that could have reasonably resulted in personal injury or illness, equipment or property damage, or an environmental excursion. Some examples include: Unsafe Conditions, Unsafe behavior, Events where injury could have occurred but did not, Events where property damage resulted or could have resulted, Events where a control measure was challenged or ignored.

1	SOS Title:						
2	Reporting Employee Name:			Employee EID:			
3	Name of Person responsible for closure:			Employee EID:			
4	Supervisor name:			Supervisor EID:			
5	Name of Contract	Contract Number		6	Address:		
7	Describe the SOS (what happened) / (Do *not use individual names if you have seen an unsafe practice)*:						
8	Honeywell HBS	9	Country: America	10	Region:	11	State:
12	Date SOS Observed:	DD/MM/YYYY					
13	Or select only one recommended time period for closing corrective action:	☐ One week ☐ Two weeks ☐ One month ☐ Three months ☐ Six months ☐ Twelve months					
14	Describe the corrective action:						
15	Date SOS to be closed (meet AOP goal):	DD/MM/YYYY					
16	Consequence of occurrence (select only one):	☐ Catastrophic (fatality) ☐ Major (hospitalisation) ☐ Serious (medical treatment/recordable) ☐ Minor (first aid) ☐ Negligible		17	Likelihood of Recurrence (select only one):	☐ Almost certain (>2 times/year) ☐ Highly likely (once per year ☐ Likely (once every three years) ☐ Unlikely (once every five years) ☐ Remote (once every ten years)	
18	Type of Hazard: (select only one):	☐ Contact in / between / under ☐ Contact with electricity ☐ Contact with sharp object ☐ Exposure to chemical (gas, dust, fume) ☐ Exposure to extreme temp. (hot/cold) ☐ Exposure to noise ☐ Exposure to low oxygen			☐ Fall from elevation ☐ Lifting / Repetitive Motion / Ergonomic exposure ☐ Liquid Splash / Contact struck against ☐ Slip / Trip / Fall (same level) ☐ Struck by ☐ Vehicle ☐ Another kind of hazard		
19	Type of SOS (select only one):	☐ Unsafe Behavior	☐ Unsafe Condition	☐ Incident with property damage		☐ Incident without property damage	
20	Location of Safety Observation (select only one):	☐ Manufacturing plant / Mill ☐ Honeywell Office ☐ Customer Office ☐ Hospital ☐ School ☐ Mechanical Room			☐ Laboratory ☐ Residence ☐ Warehouse ☐ Roof ☐ Computer Room / Control Room ☐ Vehicle ☐ Other		
21	Honeywell Risk Calculator (select only one):	☐ Major		☐ Moderate		☐ Minor	
22	Status:	☐ Open		☐ Closed			
23	Manager / Lead Signature:			Date:	DD/MM/YYYY		
	REMEMBER SAFETY IS EVERYONE'S RESPONSIBILITY						

SMP Attachment 8: Hazard Assessment Site Inventory

The following table lists each of the completed contractor work authorization forms and risk assessments for the scope of work of this contract.

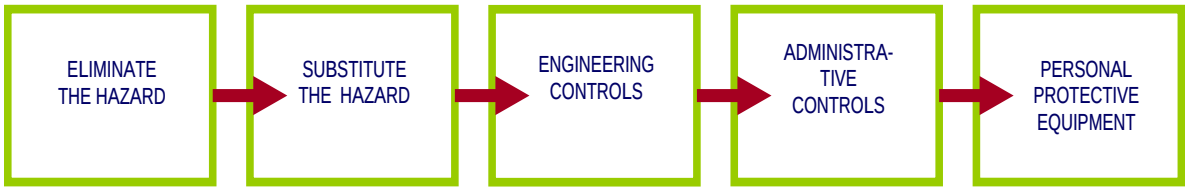
HID#	Description of Hazard, Location, Safety Permits Required	Original Date	Check which is applicable below		Review Date
			Contractor Authorization Form	Risk Assessment Form	
1					
2					
3					
4					
5					
6					
7					
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Honeywell

SMP Attachment 9: Field Risk Assessment Form

FIELD RISK ASSESSMENT FORM CRITERIA / CALCULATOR

Hierarchy of Controls



HONEYWELL RISK ASSESSMENT CALCULATOR

SEVERITY / CONSEQUENCE

PROBABILITY / LIKELIHOOD	1. Negligible	2. Minor	3. Serious	4. Major	5. Catastrophic
5. Almost Certain	Medium	High	High	High	High
4. Highly Likely	Medium	Medium	Medium	High	High
3. Likely	Low	Low	Medium	Medium	High
2. Unlikely	Low	Low	Low	Medium	High
1. Remote	Low	Low	Low	Medium	Medium

Severity / Consequence Criteria	Probability / Likelihood Criteria
Catastrophic ❑ Injury: Fatality of employees, contractors or the public. (Tier 1) ❑ Environment/Assets: Irreversible contamination of environment; Significant damage to building/equipment integrity. ❑ Public Relations: Significant public interest, national and/or international media involvement or significant impact on business reputation. ❑ Law and Permits: Federal regulatory intervention and/or regulatory fines greater then $5M to the company/unit; Government withdrawal of permits to operate the entire Honeywell unit or project.	**Almost Certain** 5. Occurred or likely to occur many times.
Major ❑ Injury: Extensive injury or Hospitalization of employees, contractors or the public. (Tier 2) ❑ Environment/Assets: Reversible contamination of environment; Moderate damage to building/equipment integrity. ❑ Public Relations: Moderate public interest, regional media involvement or moderate impact on business reputation. ❑ Law and Permits: Regional/District/State regulatory intervention and or regulatory fines greater then $1M to the company/unit; Government suspension of permits to operate a project.	**Highly Likely** 4. Occurred or likely to occur several times.
Serious ❑ Injury: Medical treatment of employees, contractors or the public. (Tier 2) ❑ Environment/Assets: Reversible small contamination of environment; Minor damage to building/equipment integrity. ❑ Public Relations: Some public interest, local media involvement or some impact on business reputation. ❑ Law and Permits: Local regulatory intervention and/or fines less then $1M to the company/unit; Customer suspension of some permits to a daily operation or written warning to Honeywell or project management.	**Likely** 3. Occurred or likely to occur once.
Minor ❑ Injury: First-aid treatment or Safety Observation of an employee, contractor or a member of the public. (Tier 3) ❑ Environment/Assets: No contamination of environment, no breach of law and no damage to building/equipment integrity. ❑ Public Relations: Little public interest, local media involvement or little impact on business reputation. ❑ Law and Permits: No suspension of permits to operate, continue daily operations, verbal warning to Honeywell or project management.	**Unlikely** 2. Might occur or likely to occur.
Negligible ❑ Injury: No injury. ❑ Environment/Assets: No impact. ❑ Public Relations: No public interest, local media involvement or no impact on business reputation. ❑ Law and Permits: No impact.	**Remote** 1. Rarely occurs.

RISK ASSESSMENT GUIDELINES

In most instances, moderate and major risks to health and safety can be adequately managed using site specific safe systems of work. For example, if a safety harness is specified as the control measure for working at height the risk assessment form should specify the pre-use inspections, selection of proper anchorage points, training of wearers, rescue of a suspended worker, etc.

For work with plant and substances consideration must be given to any safety recommendations of the manufacturer (e.g. the MSDS).

The actual workers performing the task should participate in all steps of the risk assessment process. It is crucial that the workers involved in the activity have input in the development and review of the safety measures.

Remember.
1. The risk assessment provides a written record of the process to be used to carry out a task safely. To demonstrate mutual understanding, it should be signed off by the parties who have responsibility for the tasks.
2. Management processes must be in place to ensure workers are competent and have the skills to complete the job and that there is a required level of supervision to ensure the tasks are completed as documented.
3. The risk assessment should be completed by all employees involved in the activity, not just the principal contractor or supervisor.

Describe the Site and the Scope of Work (Job Task)

The risk assessment should contain a brief description of the scope of work, location, supervisor, contractors, date & revision date where relevant.
Details of the specific area where the work is to be performed should also be included with the site details (e.g., building 1, phase 1 etc)

Document the Hazards that Make up the Scope of Work (Job Task)

In consultation with the persons performing the work, write down the hazards required to perform the scope of work/job task in the order to be carried out.
Details of the equipment and tools to be used should also be included. (e.g., fixing cabling to metal frame in roof space using an explosive powered ramset gun).

Identify Harm from Exposure to the Hazard

For each hazard, identify the harm/injury that may be caused from exposure to the hazard (s) to those engaged in the task or to others in the vicinity. For example, the main hazards from drilling concrete include exposure to hazardous silica dust, flying debris, high torque of tools and noise. The respective consequences would typically include respiratory damage, hearing damage, eye damage, sprains or cuts.
Pay particular attention to the use of plant and power tools to ensure that all safety hazards are identified.
For mobile plant check the general plant risk assessment record/Work instructions, as this will provide specific information on potential hazards associated with the plant.

Document all the Existing Risk Control Measures Associated with the Hazard to Eliminate / Reduce Risk

List all the control measures required to eliminate or minimise the risk of injury from the identified hazard (Refer to relevant Honeywell HSE Procedures). Control measures include training, instructions, information and supervision. For each hazard assess the foreseeable level of risk using the Honeywell risk assessment calculator.

Also include cross reference in the control measure column to any other risk assessments undertaken as part of the task, by referring to relevant hazard assessed (i.e. manual handling of ladders).

Risk Control Measures

Risk control measures should be selected in consultation with the relevant workers, making reference to the Honeywell HSE procedures where applicable. It may be necessary to seek advice from persons with safety training, working experience & the relevant Safety Advisor to identify the most appropriate control measure.
When selecting control measures consider:

- All persons that may be affected by the hazard, not just those involved in performing the task.
- The actual work practices on site.
- How often and for how long people are exposed to the hazard.
- The experience of workers doing the task.
- Safe work methods available and their effectiveness.
- The degree of safety training & instruction required (e.g. Safety inductions, safe work procedures, PPE use, use of MSDS's or the amount of supervision required).

Document Risk Level

Using the Risk Calculator, perform a risk assessment: evaluate the potential severity and probability (1, 2, 3, 4 or 5) of an incident for each hazard associated with the task.

Use the Risk Matrix to establish the risk ranking for each Task and Hazard; based on the Severity and Probability of an event, determine Low, Medium or High risk
Low Risk (green): Adhere to current hazard controls
Medium Risk (yellow): Control plan requires cell supervisor approval. Task should only proceed once the controls are in place
High Risk (red): Control plan must be reviewed and approved by the supervisor and site HSE. Work should not proceed until all the controls are in place and verified.
High risk tasks must also be added to site Risk Assessment tool. Activities should take place to lower risk classification.

List in priority order any additional control measures required to eliminate or reduce the hazard to the lowest exposure level possible relevant to the Hierarchy of Control.

Hierarchy of Risk Control Measures

Select control measures from the highest level practicable in levels 1 to 5 below, e.g., first try to eliminate the hazard, as this gives the best result. The measures at the lower levels are less effective and require training of workers plus frequent review of the hazards and systems of work. In some situations a combination of control measures may need to be used.

1 - Eliminate the hazard
Discontinue the activity or stop using the plant, tool or substance where practicable.
2 - Substitute the hazard
Use something safer or change the system of work
3 - Engineering controls
Use guards, fencing, safety screens, etc to separate workers from the hazard, use dust extractors on tools or exhaust ventilation to reduce dust
4 - Administrative controls.
e.g. specific worker instructions or procedures.
5 - Personal protective equipment (PPE).
Only when level 1 - 4 control measures have been considered and applied to the highest extent practicable, any remaining risk may be reduced by using PPE such as safety harness, eye protection, hearing protection, etc.

Any specific training, permits and information needed to carry out the task safely should also be noted (e.g. work at height training).

Identify Who Is Responsible

Document the names of the person's responsible for implementing the control plan (additional controls/information) to lower the risk level.

Monitor and Review the Risk Assessment

Make sure the work is supervised to ensure that the work is carried out as documented in the risk assessment.
Review the risk assessment if conditions, location, etc of the work change or after an appropriate length of time. Consider also:

- Whether the control measures are suitable for the task.
- The degree of support it has amongst the employees concerned.
- The effectiveness of control measures.

Designated Major Risk Tasks

Major risk work includes, but is not limited to:

- Unprotected work at heights >1.8 meters / 6 feet, particularly on roofs.
- Working on ladders above 1.8 meters / 6 feet.
- Entering confined spaces.
- Live electrical works.
- Working with mobile plant and machinery.
- Working near power lines.
- Working with elevating work platforms and cranes.
- Trenching and excavation.
- Work on or near gas mains or electricity supplies.
- Working with/near asbestos or lead or their removal.
- Demolition.
- Using certain hazardous substances including carcinogens.

Assessing and Reviewing Subcontractor Risk Assessments

The team leader/project manager or their delegated representative should ensure that the adequacy of subcontractor risk assessments and any associated safety documents and instructions are assessed prior to commencing work. In assessing subcontractor risk assessments consider the following:

- Compliance with Honeywell's policies and procedures.
- Has the recommended process been followed to develop the risk assessment?
- Are foreseeable significant hazards and risks to health and safety identified in relation to the nature of the works, including plant, tools and equipment used?
- Are risk control measures adequate and in line with the hierarchy of controls?
- Are all legislative requirements satisfied?
- Has the subcontractors inducted their workers into their own risk assessment?
- Is there adequate provision for supervision to ensure control?

[CLICK HERE FOR LINK TO PRE-POPULATED RISK ASSESSMENTS/SAFE WORK PROCEDURES]

FIELD RISK ASSESSMENT FORM

ASSESSMENT NO:

SITE LOCATION:

SCOPE OF WORK (JOB TASK):

PERMIT TO WORK REQUIRED? Yes ☐ No ☐

PERSON POTENTIALLY EXPOSED:				DURATION OF EXPOSURE:				FREQUENCY OF JOB:	
	ALL STAFF		CONTRACTORS		UNDER 5 MINUTES		6-15 MINUTES		CONTINUOUS/ ONGOING
	STAFF MEMBER PERFORMING JOB ONLY		VISITORS		16-30 MINUTES		31-45 MINUTES		NO OF TIMES PER WEEK
	MEMBERS OF THE PUBLIC		OTHER (SPECIFY)		46 MINS -1 HOUR		1 HOUR OR MORE		NO OF TIMES PER MONTH

HONEYWELL RISK ASSESSMENT CALCULATOR

Probability/ Likelihood \ Severity / Consequence	1. Negligible	2. Minor	3. Serious	4. Major
5. Almost Certain	Medium	High	High	High
4. Highly Likely	Medium	Medium	Medium	High
3. Likely	Low	Low	Medium	Medium
2. Unlikely	Low	Low	Low	Medium
1. Remote	Low	Low	Low	Medium

JOB HAZARD EXPOSURE OR DETAILED HAZARD AND HARM *List each of the hazards associated with the scope of work in the sequence they are encountered including possible harm and effects.*	RISK LOW / MEDIUM /HIGH *Using the Honeywell Hazard & Risk Matrix list the risk level against each hazard*	RISK CONTROL MEASURES / SPECIAL PERMIT REQUIREMENTS *List the control measures required to eliminate or minimise the risk of injury from the identified hazard (Refer to relevant Honeywell HSE Procedures)*	RISK LOW / MEDIUM /HIGH *Using the Honeywell Hazard & Risk Matrix list the risk level against each hazard*	ASSIGN RESPONSIBILITY *Write the name of the person responsible (supervisor or above): implement the control measures identified.*

I have read and understood the content of this RISK ASSESSMENT and agree to follow the requirements as outlined or alternatively contact the responsible Honeywell supervisor to revise the agreement

This risk assessment is written and approved at an administrative level. This approval does not imply that the risk assessment is a comprehensive and accurate document. Any subsequent use of the risk assessment makes it implicit upon the user to verify the accurate sequence of events, potential hazards, risks and controls.	RISK ASSESSMENT AUTHOR (PRINT NAME)	AUTHOR'S SIGNATURE	ASSESSMENT DATE
	MANAGERS NAME (PRINT NAME)	MANAGER'S SIGNATURE	ASSESSMENT REVIEW DATE

EMPLOYEE SIGNATURES

EMPLOYEE NAME (PRINT NAME)	EMPLOYEE SIGNATURE	DATE

EMPLOYEE NAME (PRINT NAME)	EMPLOYEE SIGNATURE	DATE

SMP Attachment 10: Orientation Form (Completed at Project Construction Kick-off)

Employee/Contractor:…… Contract: …… Date……...

Honeywell Representative: Bob Letso ……

Please tick ✓	Yes	No	Comments
• Honeywell/Customer HSE Policy	☐	☐	
• Discuss (or provide copies) of relevant Honeywell and/or Customer HSE procedures	☐	☐	
• Discuss/provide copy of Contractor HSE guidelines	☐	☐	
• First Aid arrangements	☐	☐	
• Location of hazardous materials listed in Hazardous Materials Register	☐	☐	
• Emergency Procedures	☐	☐	
• Evacuation Procedures	☐	☐	
• HSE Risk Assessment Worksheet	☐	☐	
• Reviewed Health and Safety Plan	☐	☐	
• Site Entry/Access requirements	☐	☐	
• Specific Training for special Area/Tasks (list below)	☐	☐	
• Works Authorization Form requirements	☐	☐	
	☐	☐	
	☐	☐	

I have completed the Orientation & Training as required for this Contract and agree to follow the guidelines and procedures as outlined in these courses.

Name	Signature	Name	Signature

SMP Attachment 10: (Completed by ALL Contractor/HW Employees prior to construction start)

I have read and understand the Risk Assessments, completed Site Orientation & Safety training as required for this Contract at (enter project name) and agree to follow all guidelines to work safely			
Print Name	Signature	Company	Date

SMP Attachment 10: (Completed by ALL Contractor/HW Employees prior to construction start)

I have read and understand the Risk Assessments, completed Site Orientation & Safety training as required for this Contract at (enter project name) and agree to follow all guidelines to work safely			
Print Name	Signature	Company	Date

SMP Attachment 11: Training Register

The following table lists the Site Specific training requirements that must be completed prior to working on the project site. These training procedures were identified as a result of the completed hazard and risk assessments observed at the contract site. All employees and contractors must be familiar with the required training for this project and agree to follow these procedures for the entire duration of the project.

Training Register				
#	Training Requirement	Contract Required (yes or no)	Who is to Complete	Comments
1	Customer orientation	Yes	Honeywell Employees	
2	Honeywell Safety Awareness / Orientation	Yes	Honeywell Employees	
3	Asbestos Awareness	Yes	Honeywell Employees	
4	Bloodborne Pathogen Awareness			
5	Canine Awareness			
6	Cold Weather Safety			
7	Compressed Gas Awareness			
8	Confined Space Awareness	Yes	Honeywell Employees	
9	Confined Space Entry – advanced training required	Yes	Honeywell Employees	
10	Cranes & Slings	Yes	Honeywell Employees	
11	Driver Safety	Yes	Honeywell Employees	
12	Electrical Arc Flash Awareness	Yes	Honeywell Employees	
13	Electrical Safety General Awareness	Yes	Honeywell Employees	
14	Emergency Preparedness Plan (Customer)			
15	Environmental Hazard	Yes	Honeywell Employees	
16	Eye & Face Protection	Yes	Honeywell Employees	
17	Fall Protection	Yes	Honeywell Employees	
18	Fire Extinguisher Usage	Yes	Honeywell Employees	
19	Hand & Power Tool	Yes	Honeywell Employees	
20	Hazard Communication	Yes	Honeywell Employees	
21	Hearing Protection	Yes	Honeywell Employees	
22	Hot Work Permit	Yes	Honeywell Employees	
23	Ladder Safety	Yes	Honeywell Employees	
24	Laser Safety			
25	Lead Safety	Yes	Honeywell Employees	
26	Line Breaking	Yes	Honeywell Employees	
27	Lock Out/Tag Out	Yes	Honeywell Employees	
28	Machine Safeguarding			
29	Management of Change	Yes	Honeywell Employees	
30	Manual Material Handling / Back Safety	Yes	Honeywell Employees	
31	Office Ergonomics	Yes	Honeywell Employees	
32	Personal Protective Equipment	Yes	Honeywell Employees	
33	Powered Industrial Trucks	Yes	Honeywell Employees	
34	Process Safety Management			
35	Refrigerant Management	Yes	Honeywell Employees	
36	Respiratory Protection	Yes	Honeywell Employees	
37	Safety Observation System (SOS)	Yes	Honeywell Employees	
38	Safe Operations Management (SOM)Training	Yes	Honeywell Employees	
Below list other customer specific training requirements, if applicable.				
1				
2				

SMP Attachment 12: Field Safety Checklist

Form completed by _____ Date _____

Honeywell requires a Field HSE Check List be maintained onsite for all current or new projects. It is to be performed prior to starting work during the initial site visit. Hazards identified are to be communicated to all personnel working at the site and referenced during future visits.

Original Date: _____ Revision Date: _____
Contractor(s): _____
Customer Name: _____ Customer Contact: _____ Address: _____
Telephone No: _____ Customer HSE Rep: _____ Phone: _____

1. Scope of work summary:

2. Personal protective equipment required on site?

	NO		YES (Honeywell)		YES (Contractor)
Fall Protection?	☐		☐		☐
Hard Hat?	☐		☐		☐
Safety Glasses?	☐		☐		☐
Hearing Protection?	☐		☐		☐
Safety Shoes?	☐		☐		☐
Protective Clothing? (specify)	☐		☐		☐
Respiratory protection? Explain:	☐		☐		☐

3. Safety hazards encountered at customer's facility (Check and explain plans for addressing the hazard).

Check for Yes	Safety Hazard	Name of Contractor / Personnel Performing Work	Plans to Address: Risk Assessment or Contractor Work Authorization
☐	Construction environment		
☐	High or low temperature materials or equipment		
☐	Welding		
☐	Laser equipment		
☐	Confined space or isolated work area		
☐	Overhead operations		
☐	Work at heights requiring a ladder, lift platform or basket; who provides the equipment and has appropriate training been completed?		
☐	Are there areas where the following conditions are present: Oxygen deficient atmosphere, toxic gases, vapors, fumes, mists, dusts, lead, mercury?		
☐	Known or suspected carcinogens including asbestos		
☐	Potential exposure to biohazards		
☐	Explosive or highly combustible materials		
☐	Excessive noise levels (signage identifies area)		
☐	High voltage (480 volts or greater) in the work area		
☐	Radiation sources		
☐	Ergonomics: excessive bending/stooping, cramped space		
☐	Slippery surfaces		
☐	Open pits, vats, trenches		
☐	Material handling requiring hoists, cranes, rigging, forklifts?		
☐	Raw or partially treated sewage		
☐	High pressure equipment		
☐	Unguarded machinery		
☐	Hot work permits required		
☐	Lockout/tagout permits required		
☐	Emergency evacuation		
☐	Special parking or security requirements		
☐	Customer hazard communication requirements		
☐	Process safety management requirements		
☐	Applicable MSDS's available; if no, who obtains them		
☐	Other hazards		

4. Specific safety considerations necessary to abide with customer's safety procedures. _____

5. Have all employees been briefed on the customer's site emergency response and evacuation plans & how will employees be accounted for in the event of an emergency? _____

6. Does the customer have a drug/alcohol policy for contractors and does it include drug testing? _____

7. Have the employees assigned to this project received appropriate safety training to prepare them for safety issues identified? _____

Complete, Sign and review on first visit or after work order changes. Revise annually. Review, sign & date:

Honeywell Manager	Employee\Contractor	Customer Representative (Optional)

SMP Attachment 13: Behavioral Observation Checklist (HW Employee Monitoring)

Utilize the Behavior Observation Checklist to identify both safe and at risk conditions in the work environment. After observation provide feedback to the employee for both safe and at risk observations. All at risk observations must have comments to identify corrective action or explanation. Only respond to questions that apply to the task

1. Observer

Report Observer Name

Observer EID

2. Observed

Observed Name

Observed EID

3.Task performed by Employee:_____

(4) Select SBU: HBS or HPS	(5) Select Pole (Americas or EMEA or AP):	(6) Region within Pole:	(7) State/District /Branch within Region:

(8) Location of Behavior Observation (select only one):

- ☐ Manufacturing plant / Mill
- ☐ Honeywell Office
- ☐ Customer Office
- ☐ Hospital
- ☐ School
- ☐ Mechanical Room
- ☐ Laboratory
- ☐ Residence
- ☐ Warehouse
- ☐ Roof
- ☐ Computer Room / Control Room
- ☐ Vehicle
- ☐ Other

(9) Date BOC Observed: DD/MM/YYYY

SAFE PATH OF TRAVEL			
Uses designated walkways to access work area	SAFE	AT RISK	N/A
Has clear view of path to travel	SAFE	AT RISK	N/A
PERSONAL PROTECTIVE EQUIPMENT (PPE)			
Head Protection	SAFE	AT RISK	N/A
Eye/Face Protection	SAFE	AT RISK	N/A
Hand Protection	SAFE	AT RISK	N/A
Foot Protection	SAFE	AT RISK	N/A
Respiratory Protection	SAFE	AT RISK	N/A
Electrical Protection	SAFE	AT RISK	N/A
Personal gas detector	SAFE	AT RISK	N/A
SAFE MOTOR VEHICLE OPERATION			
Does not use any mobile device while driving	SAFE	AT RISK	N/A
Secures equipment for safe transport	SAFE	AT RISK	N/A
Vehicle properly maintained	SAFE	AT RISK	N/A
Parking brake engaged when parked	SAFE	AT RISK	N/A
BODY POSITIONING DURING TASK			
Uses knees to lift not back	SAFE	AT RISK	N/A
Use knee pads when kneeling	SAFE	AT RISK	N/A
Watches hand placement / Keeps eyes on task	SAFE	AT RISK	N/A
Avoids pinch points or “line of fire” hazards	SAFE	AT RISK	N/A
Note: Line of fire: Struck by/against, caught in /between/under			
LADDERS			
Properly stores ladder on vehicle	SAFE	AT RISK	N/A
Ladders inspected prior to use	SAFE	AT RISK	N/A
Right ladder (step/extension) for the job	SAFE	AT RISK	N/A
Three points of contact at all times	SAFE	AT RISK	N/A
Does not use ladders in wet conditions	SAFE	AT RISK	N/A
Uses tool belt/back pack to carry tools	SAFE	AT RISK	N/A
PRE-JOB PLANNING			

Identifies all hazards in the work environment	SAFE	AT RISK	N/A
Conducts risk assessment using the risk calculator for	SAFE	AT RISK	N/A
Low / Medium or High Risks	SAFE	AT RISK	N/A
Obtains Work Permit where required	SAFE	AT RISK	N/A
Implements controls prior to starting work	SAFE	AT RISK	N/A
Communicates job activities with customer or team	SAFE	AT RISK	N/A
TOOLS			
Tools properly maintained	SAFE	AT RISK	N/A
Lock out, tag out properly applied	SAFE	AT RISK	N/A
Verifies zero energy after lock out	SAFE	AT RISK	N/A
Proper use of tools/ Uses right tool for the job	SAFE	AT RISK	N/A
Inspects tools before use	SAFE	AT RISK	N/A
INCLEMENT WEATHER			
Drinking plenty of fluids	SAFE	AT RISK	N/A
Taking rest breaks	SAFE	AT RISK	N/A
Uses ice cleats for icy conditions	SAFE	AT RISK	N/A
WORK ENVIRONMENT			
Keeps work area clean / free of trip hazards	SAFE	AT RISK	N/A
Checks work area for bees, wasps, snakes, etc	SAFE	AT RISK	N/A
HAZARD/INCIDENT REPORTING			
Reports Safety Observations	SAFE	AT RISK	N/A
Knows how to report injuries	SAFE	AT RISK	N/A
OTHER CRITICAL BEHAVIORS OBSERVED			
_____	SAFE	AT RISK	N/A
_____	SAFE	AT RISK	N/A

Describe At Risk Behavior:

Describe Safe Behavior:

Corrective action entered into SOS: Yes: **No:** **SOS Number:**

Manager / Lead Signature **Date** DD/MM/YYYY

SMP Attachment 14: Contractor Performance Safety Checklist (Contractor Audits)

Contractor Performance Safety Checklist					
Site location:		**Location of work**			
Auditor:		**Date and time**	**Date**	**Time**	
Details of work being undertaken					
Contract Number or Name					
Name of contractor					

Observed health and safety standards			**Comments**
(i) Have all contractor and sub contractor staff attended a site safety orientation course and received required HSE training?	Yes	No	
(ii) Have all contractor and sub contractor staff aware of the sites emergency procedures?	Yes	No	
(iii) Have all contractor and sub contractor staff been aware of what to do in the event of an accident and/or safety observation? (speak to contractor staff)	Yes	No	
(iv) Has the contractor made adequate first aid provision?	Yes	No	
(v) Have safety observations been submitted to Honeywell on a periodic basis?	Yes	No	
(vi) Are the contractor and sub contractor risk assessments, safe work procedures, method statements, HSE procedures, and permits to work being followed?	Yes	No	
(vii) Has required PPE, e.g. hard hats, safety boots, etc. been provided according to the risk assessment and is it being worn?	Yes	No	
(viii) Has the contractor implemented life critical control measures for fall protection, electrical safety, arc flash, and permit confined spaces?	Yes	No	
(ix) Where applicable are the contractor works securely fenced off or otherwise protected from the public, staff, etc?	Yes	No	
(x) Is the contractor maintaining a safe work area and implementing good housekeeping standards, including safe egress to roads, aisles, stairs, etc.?	Yes	No	
(xi) Is the contractor holding regular tool box talks with employees?	Yes	No	
(xii) Other observations			

Auditor: *I hereby declare that I have completed health and safety monitoring on the contractor named above*

Name (capitals)		Signature			
Job Title		Time		Date	
Contractors representatives name		Signature		Date	
Site managers name		Signature		Date	

SMP Attachment 15: Vehicle, Tool, & PPE Inspection Checklist (Honeywell Employees)

EMPLOYEE NAME: Jim Shearman	VEHICLE #: 63510
SUPERVISOR NAME: Bob Letso	VEHICLE MILEAGE: 6250
LOCATION ID# VEHICLE ASSIGNED: 161	INSPECTION DATE (MM/DD/YY): 07/01/16

	Insp	Test	Items	OK	DEV	N/A	Deviations: Enter a brief description of deviation, action taken, and date corrected
VEHICLE SAFETY ITEMS	x		**Housekeeping -** vehicle, tools, and equipment are neat and orderly, items in driver compartment are adequately secured	X			
	x		**Ladder racks** - in good condition, hardware intact, operates easily, ladders secure			X	
	x		**Exterior/Body damage** - exterior clean and in good condition (note all damage including scratches, dents, etc.)	X			
	x	x	**Lights** visible and operational - headlights (low & high beam), tail lights, brake lights, emergency flashers, other lights	X			
	x	x	**Windshield washer system/wipers/fluid** - operating properly, good condition, appropriate fluid level	X			
	x	x	**Seatbelt** - available and in good condition	X			
	x		**Glass & mirrors** - clean, no cracks or pits in areas that obstruct driver's view, mirrors securely mounted, properly positioned	X			
	x	x	**Tire Condition and Pressure** - appropriate tire wear and pressure (including spare)	X			
	x	x	**Fluid levels -** verify that oil is full, no fluid leaks	X			
	x	x	**Tire Condition and Pressure** - adequate tread depth and appropriate tire wear, proper pressure (including spare)	X			
	x	x	**Brakes** - operating properly (per driver's verbal report), verify that emergency brake operates properly	X			
	x	x	**Doors & locks** - door catches and handles work properly, locks work properly and can be secured	X			
	x		**Fire extinguisher** - mounted within vehicle, gauge needle in "green" zone or otherwise indicates "full"	X			
	x		**First aid kit** - vehicle kit available and adequately stocked	X			
	x		**Chocks and cones -** available, as needed			X	
	x		**Vehicle registration, insurance card, driver's license, Honeywell driver's guide, fuel card** -present, current, available for appropriate vehicle	X			
LADDERS & FALL	x		**Ladders** - Rungs, rails, hardware, rope in good condition. Appropriate ladder size and type available (non-conductive ladder available when electricity could be encountered)			X	
	x		**Fall protection equipment** - harness, lanyard, anchoring equipment inspected and in good condition. Complete system from same manufacturer. Harness and lanyard stored properly (without twisting, bending, away from chemicals and direct sunlight). Replaced according to manufacturer guidance.			X	
PPE	x		**Eye protection** - readily available, clean, in good condition	X			
	x	x	**Hard hat** – in good condition, no cracks or dents. Cradle system intact and in good condition. Clean surface.	X			
	x		**Hand and foot protection** - available and in good condition	X			
	x		**Hearing protection** – appropriately selected, clean, in good condition, stored properly	X			

	x	x	**Respiratory protection** - appropriately selected, in good condition, stored properly			X	
TOOLS & EQUIPMENT	x		**Power tools** - in good condition; cords, plugs, prongs present and good condition; grounded or double insulated; no broken pads; guards in place; removed from service/replaced promptly if poor condition detected			X	
	x		**Pneumatic tools** - hose/whip secured to tool by positive means (to prevent tool from being accidentally disconnected); safety clips or retainers used on impact/percussion tools			X	
	x		**Hand tools** - Good condition, no mushroomed heads, no broken or cracked parts; removed from service/replaced promptly if poor condition			X	
	x		**Fuel-powered tools/equipment** - good condition; stored so as to prevent spilling of fuel during transport; when in use in enclosed spaces, measures are taken to prevent build-up of gases and fumes; stopped for refueling, service, and maintenance			X	
ELECTRICAL	x		**Extension cords** - cord and plugs in good condition (no cracks, cuts, or tape), prongs intact, cord is grounded or double-insulated (and/or GFI available)			X	
	x		**Lockout/Tagout** - appropriate devices available (locks, tags, hasps, etc.), appropriate variety available for job conditions			X	
	x	x	**Amp Meter** - clean, no damage, proper storage, good working order, test battery			X	
COMPRESSED	x		**Torches, hoses, regulators** - fittings in good condition, no leaks, auto shut-off tested, hoses & connections designed for pressure and service to which subjected; equipped with backflow prevention or flash arrestor			X	
	x		**Gas cylinders** - turned off, stored upright with caps in place, secured (to prevent tipping), properly labeled, used with appropriate PPE, regulators and torches removed and/or disconnected from cylinders when not used			X	
	x		**Personal Protective Equipment for Hot Work** (i.e. face shield, body protection, etc.) - protective equipment available and in good condition			X	
MISCELLANEOUS	x		**Outdoor/inclement weather supplies & equipment** - appropriate supplies available for hazards encountered (i.e. drinking water/fluids, snow/ice management equipment {sand, shovels, etc.], insect spray [di-electric spray required if working near electricity], sunscreen, etc.)			X	
	x		**Chemicals** - only "approved" chemicals used, all containers properly labeled, containers stored properly (secured). Material Safety Data Sheets (MSDS) on file at HON office. If refrigerant is distributed, logs are available and up-to-date.			X	
	x		**Hand lines and ropes** - no cuts, abrasions, decay, burns, signs of wear			X	
	x		**Portable blowers** - in good condition, proper ratings on blower, proper set-up and use (test)			X	
	x	x	**Air monitoring equipment (for confined space entry)** - appropriate for job conditions and hazards potentially encountered, in good condition and functioning properly, test/calibrate equipment according to requirements, appropriate calibration gases and test kit available			X	
	x	x	**Electrical insulating gloves (for electrical hot work) -** if used and available, ensure appropriate class/type for use, verify current inspection/test date stamp rubber protective layer (w/in past 9 mos.), stored in bag with fingers upright, stored away from direct sunlight in dedicated bag			X	
	x		**Electrical mats/barriers** - Mats and barriers in good condition, no tears, rips or holes. Appropriate for hazards encountered.			X	
	x		**Gasoline** - stored in approved flammable liquid container with self-closing lid, flame/flash arrestor. Stored to prevent tipping. Maximum capacity stored less than 5 gallons.			X	
	x		**Heaters** – equipped with proper shut-off (tip over protection), use only approved heaters in good condition.			X	
	x		**Permits** - verify adequate supply of required permits (Hot Work, Live Electrical, Permit-Required Confined Space Entry, etc.)	X			

SMP Attachment 17: Emergency Response Plan

HBS & HPS Facilities Emergency Response Plan

Honeywell Business Unit:	EES-Customer Site - Morris County School of Technologyl
Street Address:	400 E Main St
City, State, Zip:	Denville, NJ 07834
Date of ERP Review:	



Emergency Response Preparedness (ERP) Checklist: ***(Click on PDF)***



SMP Attachment 17: Emergency Response Plan

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1. EMERGENCY PREPAREDNESS PLAN SCOPE:

Honeywell International Inc. (Honeywell) will provide a safe and healthy work environment. Consistent with policy, the following emergency action plan is developed for this site and will guide the actions taken by employees, management, and emergency coordinators. Emergency events addressed by this plan include building evacuation, fires, severe weather, medical emergencies, Bomb Threats or other facility-related emergencies that could endanger employees and/or visitors to this Honeywell location.

2. HSE HOTLINE REPORTING GUIDANCE:

Report all Injuries and Illnesses and Emergency Events addressed within this reporting procedure to the **Honeywell Hotline at (866-466-1765).** Early Post Injury Reporting with Immediate First Aid measures can reduce Injury Severity & Eliminate the need for Future Medical Care (Recordable Injuries).

3. DRILLS/TEST OF EMERGENCY PREPAREDNESS PLAN:

Familiarity with responsibilities and procedures must be thorough so that response to the plan is automatic. Each location is responsible for accomplishing at least one emergency situation drill every twelve (12) months. After accomplishing the emergency situations drill it must be documented on the Emergency Preparedness Drill Critique.

4. FACILITY IDENTIFICATION, DESCRIPTION, GENERAL INFORMATION:

Office Name/LID	Customer Site, Morris County School of Technology
Address	400 E Main St, Denville, NJ 07834
Description of Bldg, Usage	School / Administrative Building
Location Description, Cross Streets, Directions	
Facility Utilities, Nearby Buildings	

5. EMERGENCY COORDINATOR INFORMATION

THE EMERGENCY COORDINATOR HAS PRIMARY RESPONSIBILITY FOR ASSURING THE IMPLEMENTATION OF THIS EMERGENCY PREPAREDNESS PLAN AND REQUIREMENTS STATED HEREIN. WHEN EMERGENCIES OCCUR, THE EMERGENCY COORDINATOR MAINTAINS PRIMARY RESPONSIBILITY FOR APPROPRIATE NOTIFICATIONS TO EMPLOYEES, HONEYWELL MANAGEMENT, MUNICIPAL EMERGENCY SERVICES (I.E. FIRE AND/OR POLICE DEPARTMENTS), AND OTHER AGENCIES OR SERVICES THAT MAY ASSIST IN MANAGEMENT OF THE EMERGENCY.

The alternate Emergency Coordinator serves in place of the Emergency Coordinator when the primary coordinator is unavailable. (It is recommended that these positions be filled with employees who are typically in the building for the majority of the workday.)

A. THE PRIMARY EMERGENCY COORDINATOR FOR THIS FACILITY IS:

Name	Paddy Phelan
Title	Project Manager
Office Phone	
Pager or Cell	516-448-8645
Alternate Phone	

B. THE ALTERNATE EMERGENCY COORDINATOR FOR THIS FACILITY IS:

Name	
Title	
Office Phone	
Pager or Cell	
Alternate Phone	

6. HONEYWELL CRISIS COMMUNICATION:

Major crisis situations often generate interest from the news media and require effective internal communications to address employee concerns. As soon as possible following a major crisis event, contact the Communications Leader to discuss the situation so appropriate internal and external communications plans and tools can be developed. Examples of such times where crisis reporting should be accomplished include the following:

a. Catastrophic facility damage caused by fires, storms, explosions, or earthquakes, tsunamis, accidents that may result in severe injury and threats or acts of violence or terrorism

b. Other unexpected events that have the potential to cause harm to Honeywell's employees, reputation, competitive positioning, or financial viability.

I. INTERNAL RESOURCE NUMBERS: It is always appropriate to contact the local site leader if they are not on-site at the time of the incident. Additionally, based on the nature of the event/injury it may also be necessary to contact other Honeywell personnel listed below:

	Name	Office Phone	Cell Phone
Local Site Leader(s)	Paddy Phelan		516-448-8645
HSE Leader	Steve Serian	603-930-0222	603-930-0222
Facilities Manager			
HR Leader			
ACS Security Director	Jeff Soholt	763-954-6123	952-303-1648

- **Additional Links**
  - **Corporate Communication Policy**
  - **Corporate Communication Contacts**

II. EXTERNAL RESOURCES / EMERGENCY PHONE NUMBERS:

	Name	Phone
Police Department		911
Fire & Ambulence		911
Building Landlord/Manager		
Other		

7. EMERGENCY EVACUATION SYSTEM:

A fire alarm will be used to alert employees within the building of fire or severe weather emergency or other need to evacuate the building or to seek shelter in place. In buildings that are not equipped with audible emergency alarms, employees will be alerted to other emergencies through direct verbal communication from the Emergency Coordinator(s) and/or designated alternate.

The Emergency Coordinator or designated alternate will make physical contact with employees who have sight or hearing disabilities to ensure that they are aware of the emergency.

a. BUILDING EVACUATION:

Evacuation of employees to a rally point outside of the building or to a refuge area within the building will be enacted whenever there is a threat to their safety or health because of an emergency condition. The refuge area shall be a safe area within the building away from windows where employees can gather, for example, in severe weather. The Emergency Coordinator is authorized to enact the evacuation of a particular room, floor, or the building.

- ✓ The designated rally point is:
  Specify: Front of building, parking lot, or main entrance
  If the designated rally point is involved in the emergency, the alternate rally point will be:
  Specify: Parking lot.
- ✓ The designated (indoor) refuge area is:
  Specify: vaires by building.
- ✓ The Emergency Coordinator and Team will be responsible for accounting for all employees, visitors and contractors. If personnel are unaccounted for after conducting the headcount at the rally point, the Emergency Coordinator will be the designated person responsible for communicating with emergency services.
- ✓ Re-entry to the building will be coordinated through emergency services and the Emergency Coordinator. In the event of an incident preventing re-entry, the Emergency Coordinator will work with senior management, Facilities, and Health, Safety, Environmental (HSE) departments to assure the safety of the building and personnel.
- ✓ Injured personnel will receive medical care through the municipality's emergency response system.
- ✓ In the event an unplanned evacuation results from an actual site emergency, the Emergency Coordinator shall ensure appropriate notifications are made to site leadership.
- ✓ A diagram or description of the evacuation routes, exit doors, rally points and refuge areas are posted:
  Specify: See evacuation routes posted on walls.
  The designated exit doors for this facility are (list exit doors).
- ✓ Know the locations of your building evacuation route, outdoor rally point, and indoor refuge area before an emergency occurs by reviewing the posted/attached instructions and/or evacuation map.

8. MEDICAL EMERGENCY:

Remember to report all injuries no matter how minor to your manager and HSE leader immediately and the **Honeywell Hotline at (866-466-1765).** *Never enter into a medical emergency area unless you are sure there are no hazards present. Scan the area visually, overhead as well, to ensure that there are no physical dangers present. We do not want to delay the initial medical emergency response nor do we want to provide additional responses to would-be rescuers. Never move or attempt to render any assistance that could impact greater injury to the already injured victim.*

The following steps to be taken in the event of an on-site medical emergency:

a. *Immediately contact First Aid personnel and dial 9-911 for assistance, such as loss of consciousness, uncontrolled bleeding, potential heart attack or stroke and give exact location and nature of the emergency.*

b. *Remember, when First Aid arrives, they are in charge. Persons in the immediate area should be limited to only those identified by the First Aid Attendant. The First Aid Person will provide direction and course of action.*

c. *If further medical assistance is required, the First Aid Attendant or designate will contact dial 911 and request an ambulance be dispatched*

9. FIRE EMERGENCY (Evacuate and call 9-911):

To protect yourself, it is important to understand the basic characteristics of fire. Fire spreads quickly so there is no time to gather valuables or make a phone call. In just two minutes, a fire can become life-threatening. In five minutes, a residence can be engulfed in flames. Heat and smoke from fire can be more dangerous than the flames. Inhaling the super-hot air can sear your lungs. Fire produces poisonous gases that make you disoriented and drowsy. Asphyxiation is the leading cause of fire deaths, exceeding burns by a three-to-one ratio.

a. Protective Measures for Fires:

- ✓ Insure smoke alarms are installed, tested and cleaned in accordance with applicable instructions.
- ✓ Ensure Fire Suppression Systems are maintained and tested in accordance with applicable instructions.
- ✓ Ensure Fire extinguishers are in place and serviceable.
- ✓ Accomplish Annual Emergency Fire Drills to prepare employees.

b. Escaping the Fire:

- ✓ Review escape routes with personnel and practice escaping from each room.
- ✓ Ensure security doors and other antitheft mechanisms that could block outside window entry are easily opened from the inside.
- ✓ Remain low to the floor (where the air is safer in a fire) when escaping from a fire.
- ✓ Clean out storage areas. Never allow trash, old newspapers, boxes or magazines to accumulate.

c. Flammable Items:

- ✓ Never use gasoline, benzene, naphtha, or similar flammable liquids indoors.
- ✓ Store flammable liquids in approved containers in well-ventilated storage areas.

d. Fire sources and smoking:

- ✓ Never smoke near flammable liquids
- ✓ Smoke only in designated smoking areas as described below:

Specify: None, No smoking on site.

Provide deep sturdy ashtrays or outdoor approved cigarette/cigar disposal cans.

e. Heating Sources

- ✓ Be careful when using portable heating sources.
- ✓ Ensure space heaters are at least three feet (1 meter) away from combustible materials.
- ✓ Ensure Portable heating devices have a tilt shutoff as well as a timer shutoff.
- ✓ Always unplug Portable Heating Devices when not in use.

f. Electrical Wiring:

- ✓ Ensure electrical wiring is not exposed.
- ✓ Never Daisy Chain extension cords.
- ✓ Inspect extension cords for frayed or exposed wires or loose plugs.
- ✓ Make sure outlets have cover plates and no exposed wiring.
- ✓ Make sure wiring does not run under rugs, over nails, or across high-traffic areas.
- ✓ Do not overload extension cords or outlets. If you need to plug in two or three appliances, get a UL-approved unit with built-in circuit breakers to prevent sparks and short circuits.

g. During a Fire If your clothes catch on fire:

- ✓ Stop, drop, and roll until the fire is extinguished.

10. TERROIST / BOMB / BIOLOGICAL / CHEMICAL / RADIOLOGICALTHREAT EMERGENCY:

a. Remain calm, listen carefully and record the following details:

- ✓ *Time the call was received,*
- ✓ *Details of the threat (Where is the bomb or When it is expected to explode),*
- ✓ *Details of the caller (voice tone – angry, joking, sarcastic, quiet, business-like),*
- ✓ *Background noise (car noise, street noise, television, radio),*
- ✓ *Time the call ended*

c. Notify Local Police Department, Honeywell Management and Security immediately.

Bomb, Chemical and/or Biological Threat Guideline

Detailed DESCRIPTION OF CALLER'S VOICE	***Ask the below EXACT WORDS upon BOMB THREAT***
Male _____ Female_____ Young _____ Middle Aged _____ Older_____ _____ Calm _____ Nasal _____ Angry _____ Stutter _____ Excited _____ Lisp _____ Slow _____ Raspy _____ Rapid _____ Deep _____ Soft _____ Cleared Throat _____ Loud _____ Deep Breathing _____ Laughter _____ Cracked Voice _____ Crying _____Accent _____ Normal _____Familiar _____ Slurred _____Disguised BACKGROUND SOUNDS _____ Street _____ Factory _____ Animal _____ Clear _____ Voices _____PA System _____ House _____Traffic _____ Other *THREAT LANGUAGE* _____*Well spoken* _____ *Incoherent* _____Foul/ Irrational _____ Read Message?	*1. Where is the device right now?* *2. What does it look like?* *3. What kind of a device is it?* *4. Why are you doing this?* *5. What is your name?* 6. Are you part of an organization? *7. Why are you warning us?* 8. What will cause it to activate?
*Person receiving call*_____ *Time Caller hung up*_____ *Phone number at which call was received*_____ *Date*_____	

11. HAZARDOUS CHEMICALS:

If applicable, identify and list below all hazardous chemical quantities stored on site. Otherwise state "Not Applicable" to this location.

✓ **Inside and/or outside locations:**
✓ **Quantities of hazardous materials:**
✓ **Physical and/or chemical hazards, i.e., asphyxiation hazards**
✓ **Hazardous material properties, i.e. flammability, toxicity. Reference location of Safety Data Sheets**

12. INTERNAL HAZARD / CONTROL MEASURES:

Include in this section any process operations that may fail during an emergency event.

Possible Failures	**Emergency Control Measure Description**

The following are examples of process operations that are addressed in the procedure, but do not need to be part of this section if not applicable to your location: *(Truck/railcar deliveries, transfer of materials, utilities, pollution control devices, control rooms, pipelines, control valves, ventilation systems, boilers, pressure vessels, security access controls, fire protection systems, identify existing engineering control measures to avoid release of hazardous materials).* However, if applicable, prepare emergency control measures for each potential failed process that may apply to your location.

13. EMERGENCY DRILL REQUIREMENTS

a. Annual Emergency Evacuation Drills

- ✓ *Drills must be accomplished annually and include different types of Emergency Scenarios as outlined in this Emergency Preparedness Plan*
- ✓ *Upon completion of the Emergency Evacuation Drill use the Critique Form to Document Drill.*
- ✓ *In accordance with Corporate Policy,* once the Emergency Evacuation Drill is complete, forward the Critique Form to regional HSE Manager for entry into the Corporate Event Tracking System.

b. Annual AED Emergency Drill

- ✓ *If a location has more than 200 employees an AED is required.* Before making the determination to purchase an AED, contact your Regional Safety Manager.
- ✓ Locations with AEDs must conduct AED drills at least annually on all shifts where AED trained personnel are present. These drills must be documented and must measure the actual response time.
- ✓ When AED drill response times are greater than or equal to 5 minutes, the organization must create a corrective action plan to reduce the response time to less than 5 minutes. *This action plan must be documented in the Corporate Event Tracking System by the HSE Manager*. Corrective actions must include a mechanism for ensuring the response time of 5 minutes or less is met.

14. NATURAL DISASTERS:

a. TORNADO EMERGENCY:

I. Tornado Terms:

- ✓ **Tornado Watch:** Means Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA Weather Radio, commercial radio, or television for information.
- ✓ **Tornado Warning:** A tornado has been sighted or indicated by weather radar. Take shelter immediately.

II. Protective Measures before and during a Tornado:

- ✓ Listen to NOAA Weather Radio or to commercial radio or television newscasts for the latest information & remain alert.
- ✓ Look for approaching danger signs such as a dark greenish sky or dark low-lying cloud with rotation or evidence of large hail.
- ✓ Listen for a loud roar, similar to a freight train.
- ✓ If you see approaching storms or any of the danger signs, be prepared to take shelter immediately or if you're under a tornado WARNING, seek shelter immediately!
- ✓ If inside an enclosed structure such as a small building, school, nursing home, hospital, factory, shopping center or high-rise building, go to a pre-designated shelter area such as a safe room, basement, storm cellar, or the lowest building level. If there is no basement, go to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck. Do not open windows.
- ✓ If outside with no shelter lie flat in a nearby ditch or depression and cover your head with your hands.
- ✓ Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

b. HURRICANE/CYCLONE EMERGENCY:

I. Hurricanes Terms:

- ✓ **Hurricane/Cyclone and Tropical Storm Watch**: Hurricane/tropical storm conditions are possible in the specified area, usually within 36 hours. Tune in to NOAA Weather Radio, commercial radio, or television for information.
- ✓ **Hurricane/Cyclone and Tropical Storm Warning**: Hurricane/tropical storm conditions are expected in the specified area, usually within 24 hours.

II. Hurricane/Cyclone Protective Measures before and during a Hurricane:

- ✓ Make plans to secure property by closing all windows, doors and roof vents if possible.
- ✓ Determine a safe room / location for shelter.
- ✓ Listen to the radio or TV for information.
- ✓ Turn off utilities if instructed to do so.
- ✓ Evacuate building if directed by local authorities and be sure to follow their instructions.

c. EARTHQUAKE EMERGENCY:

I. Protective Measures before and during an Earthquake:

- ✓ *Keep your cool, avoid panic and confusion and ride out the motion.*
- ✓ *Take cover under a sturdy desk, table, or bench or against an inside wall, and hold on. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.*
- ✓ *Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.*
- ✓ *Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported, load bearing doorway.*
- ✓ *Remain inside until shaking stops and it is safe to go outside. Most injuries during earthquakes occur when people are hit by falling objects when entering into or exiting from buildings.*
- ✓ *Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on.*
- ✓ *Do not use elevators during an Earthquake.*

II. Post Earthquake Protective Measures: *Being prepared for aftershocks are extremely important. Even though secondary shockwaves are usually less violent, they can be strong enough to cause additional damage to already weekend structures.*

- ✓ *Check for injuries amongst those around you. Notify First Aid of injured persons as soon as safe to do so. Do not move the seriously injured unless they are in immediate danger. Try and keep the injured warm.*
- ✓ *Contact local emergency resource centers such as the hospital or fire department as required for injuries or fire concerns or call 9-911.*
- ✓ *Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or relief organizations*
- ✓ *Listen for sounds or smell of leaking gas and exit building if the smell of gas apparent.*
- ✓ *Be aware of possible tsunamis if you live in coastal areas. These are also known as seismic sea waves (mistakenly called "tidal waves"). When local authorities issue a tsunami warning, assume that a series of dangerous waves is on the way. Stay away from the beach.*
- ✓ *Always open cabinets cautiously as objects may have shifted causing falling hazards.*
- ✓ *Never leave the worksite area unless you have advised your Site Manager. You may be jeopardizing your safety (bridge or road damage, et cetera) as well as create traffic congestion for emergency vehicles.*
- ✓ *If evacuation is ordered, leave by the nearest emergency exit and report directly to your designated assembly/rally point.*

d. VOLCANO EMERGENCY:

I. Protective Measures before and during a Volcanic Eruption:

- ✓ Monitor local radio stations and News Broadcasts

- ✓ Ensure the building / office ventilation system is turned off. This will keep ash particulates from entering building.
- ✓ Cover sensitive equipment with plastic sheets to keep ash particulates from entering parts.
- ✓ Evacuate immediately from the volcano area to avoid flying debris, hot gases, lateral blast and lava flow.
- ✓ Wear long-sleeved shirts and long pants.
- ✓ Use goggles and war eyeglasses instead of contact lenses.
- ✓ Use a dust mask or hold a damp cloth over your face to help with breathing.
- ✓ Stay away from areas downwind from the volcano to avoid volcanic ash.
- ✓ Stay indoors until the ash has settled unless there is a danger of the roof collapsing.
- ✓ Close doors, windows and turn off all ventilation systems.

e. TSUNAMI EMERGENCY:

I. Understanding Tsunamis Terms:

- ✓ Advisory: An earthquake has occurred in the Pacific basin, which might generate a tsunami.
- ✓ Watch: A tsunami was or may have been generated, but is at least two hours travel time to the area in Watch status.
- ✓ Warning: A tsunami was, or may have been generated, which could cause damage; therefore, people in the warned area are strongly advised to evacuate.

II. Tsunami Protective measures before and during a tsunami event:

- ✓ Turn on your radio to learn if there is a tsunami warning if an earthquake occurs and you are in a coastal area.
- ✓ Move inland to higher ground immediately and stay there.
- ✓ **Visual Indication of Imminent Tsunami** - Strong Earthquake lasting 20 seconds or more where it is difficult to stand or walk or the water level at the beach begins receding / being pulled back into the ocean.

15. Insert PDF of Building Evacuation Map and Location of Fire Extinguishers on Following Page

Insert PDF map on here or on next page

See evacuation plans posted on walls of buildings.