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Local Government Energy Program
Energy Audit Final Report

Ocean County Vocational Technical School

Waretown Center
423 Wells Mills Rd.
Waretown, NJ 08758

Project Number: LGEA100

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EXECUTIVE SUMMARY

The single-story slab on grade 24,000 square feet OCVTS Waretown Center Vocational & Technical School was built in 1971. It is a T-shaped building. The main entrance section of the building has the main office, principal office, nurse's office, faculty room, 2 classrooms and a computer lab. The rear portion of the building has 4 shop rooms, a custodial room, and the boiler room. The following chart provides a comparison of the current building energy usage based on the period from January 2011 through December 2011 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) including any renewable energy:

Table 1: State of Building—Energy Usage

	Electric Usage (kWh/yr)	Gas Usage (therms/yr)	Current Annual Cost of Energy ($)	Site Energy Use Intensity (kBtu/sq ft /yr)	Source Energy Use Intensity (kBtu/sq ft /yr)	Joint Energy Consumption (MMBtu/yr)
Current	316,372	21,366	$71,143	139.8	243	3,216
Proposed	237,073	17,417	$53,027	112.1	189	2,551
Savings	79,300	3,949	$18,116*	27.7	55	665
% Savings	25.1%	18.5%	25.5%	19.8%	22.5%	20.7%
Proposed Renewable Energy**	93,158	0	$81,590	13.2	13.2	318
*Includes operation and maintenance savings; **Includes SRECS						

SWA has entered energy information about the Waretown Center facility into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The building has an Energy Star Rating of 27 and a Site Energy Utilization of 134 kBtu/sqft/yr.

Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period	Initial Investment ($)	CO2 Savings (lbs/yr)
0-5 Year	$15,972	1.6	$25,672	159,989
5-10 Year	$2,144	8.2	$17,544	25,524
Total	$18,116	2.4	$43,216	185,513
Proposed Renewable Energy	$81,590	4.7	$384,800	166,799

Energy Conservation Measure Implementation

SWA recommends that OCVTS implement the following Energy Conservation Measures using an appropriate Incentive Program for reduced capital cost:

Recommended ECMs	Incentive Program (APPENDIX K for details)
Retro-commissioning	N/A
Retrofit 1 refrigerated vending machines with VendingMiser™ Devices	N/A
Install 29 new occupancy sensors	Direct Install, Smart Start
Retrofit 1 snack vending machines with SnackMiser™ Devices	N/A
Replace High Pressure Sodium parking lot lighting with 20 new LED fixtures	Direct Install, Smart Start
Install 77 kW Solar Photovoltaic system	NJ SREC program
Upgrade 12 High Pressure Sodium fixtures to pulse start Metal Halide fixtures	Direct Install, Smart Start

Appendix L contains an Energy Conservation Measures table

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 15 cars from the roads each year or is equivalent of planting 452 trees to absorb CO_2 from the atmosphere.

In addition to these ECMs, SWA recommends the following Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:

- Check and adjust timers and time clocks monthly
- Replace motors with NEMA premium efficiency models
- Replace existing thermostats with electronic thermostats
- Review VFD installation
- Provide water-efficient fixtures and controls
- Inspect and replace cracked/ineffective caulk.
- Inspect and maintain sealants at all windows for airtight performance.
- Inspect and maintain weather-stripping around all exterior doors and roof hatches.
- Purchase Energy Star® appliances when available
- Use smart power electric strips
- Create an energy educational program

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 40-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Waretown Center Vocational & Technical School at 423 Wells Mills Rd., Waretown, NJ. The process of the audit included a facility visit on April 3rd and April 18th, benchmarking and energy bill analysis, assessment of existing conditions, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Ocean County Vocational Technical School to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Waretown Center facility.

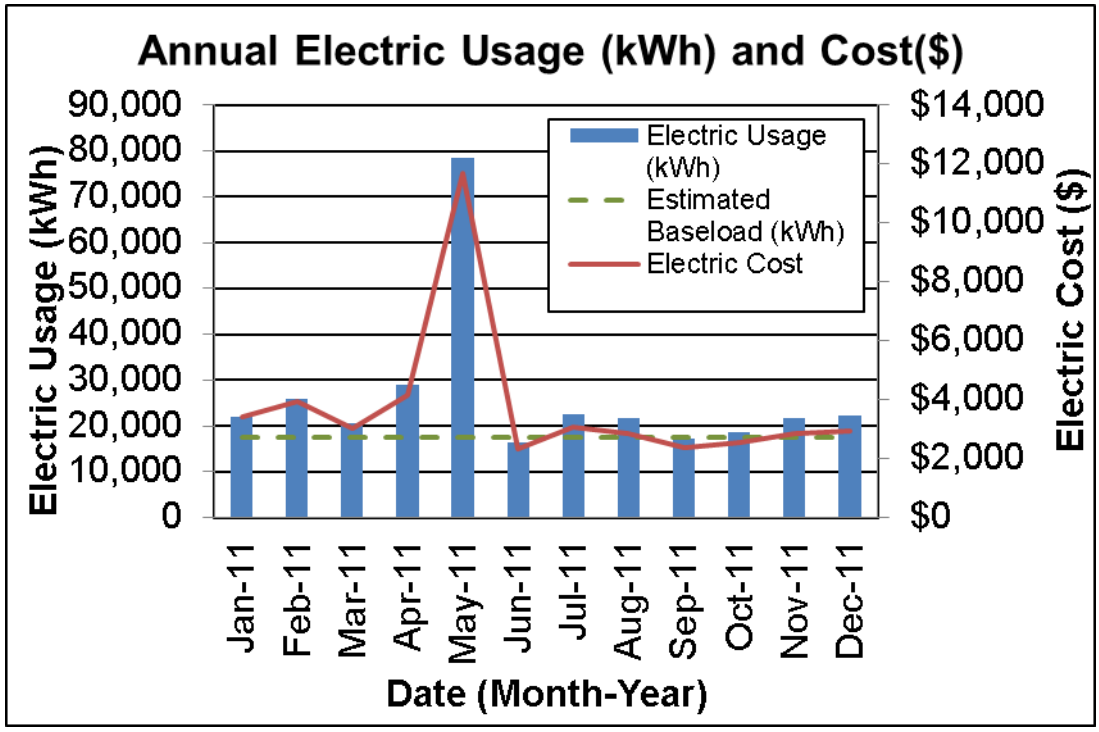
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility data from January 2011 through December 2011 that were received from the utility companies supplying Waretown Center with electricity and natural gas. A 12 month period of analysis from January 2011 through December 2011 was used for all calculations and for purposes of benchmarking the building.

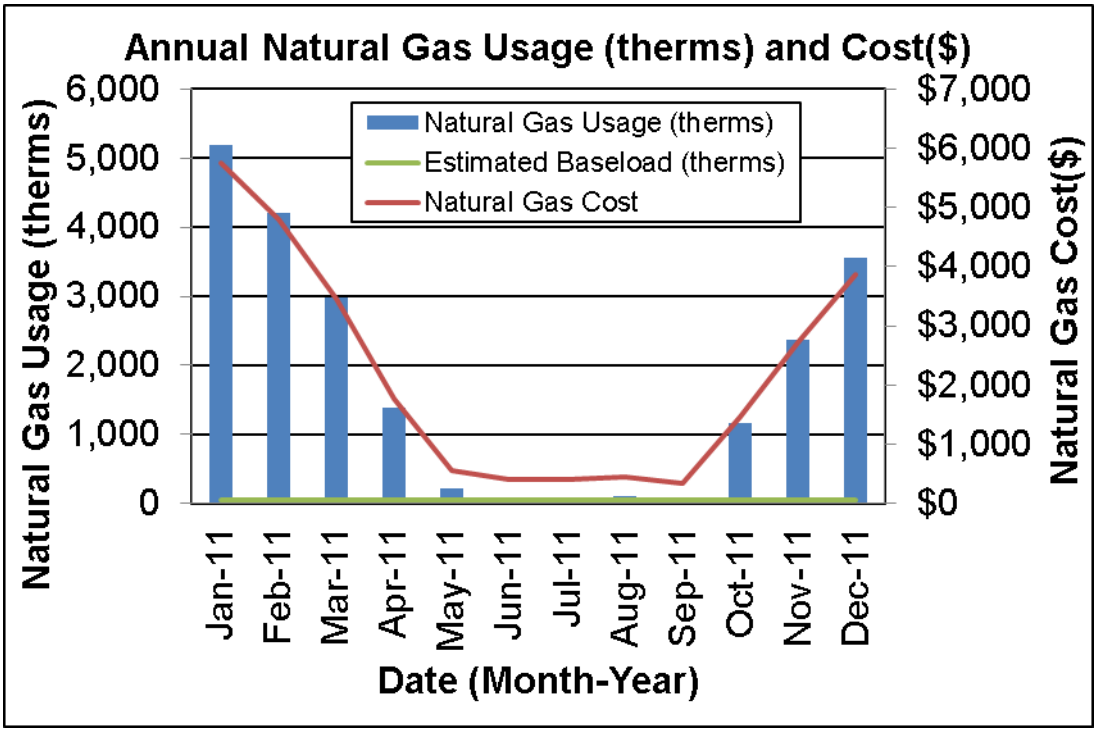
Electricity – Waretown Center is currently served by one electric meter. The school currently purchases electricity from Jersey Central Power & Light. Electricity was purchased at an average aggregated rate of $0.143/kWh and the school consumed approximately 316,372 kWh, or $45,171 of electricity, from January 2011 to December 2011.

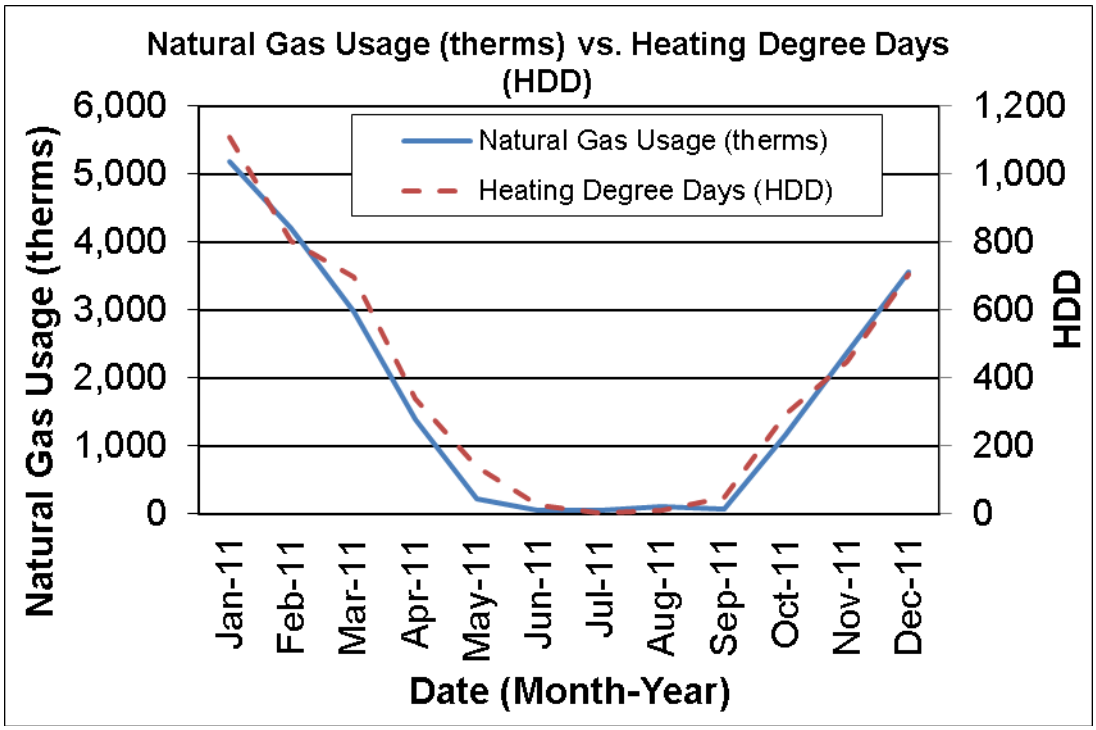
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate Waretown Center Vocational & Technical School. The baseline usage for the facility is approximately 16,867 kWh (average of the three lowest consumption months). As is typical of schools, electric usage peaks in May and June, while the building is using cooling and school is still in session. However, a spike of nearly 3 times the typical monthly usage in May with a significant reduction in June is not typical and should be investigated further. This may be due to a billing error or billing correction, however, this can not be verified because SWA was not provided with actual copies of the bills.



Natural gas – Waretown Center Vocational & Technical School is currently served by one meter for natural gas and currently purchases natural gas from New Jersey Natural Gas which is responsible for transmission and distribution and from Hess which acts as a third party energy supplier. Natural gas was purchased at an average aggregated rate of $1.216/therm and the

school consumed approximately 21,366 therms, or $25,972 of natural gas, from January 2011 to December 2011. The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the Waretown Center Vocational & Technical School during the heating season. The baseload, of 59 therms, is the average of the lowest three months of usage. There is no heating during the summer months which is why the baseload is so low on the graph below. As is typical, usage peaks in the winter months in conjunction with the operation of the gas fired heating hot water boiler.

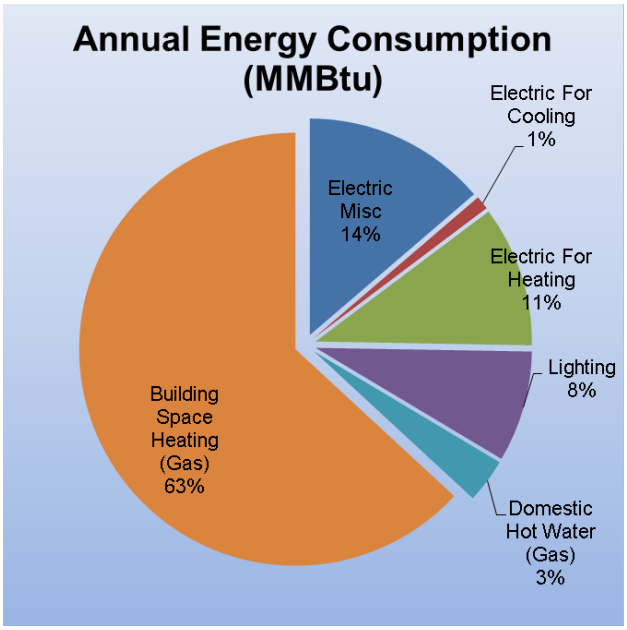


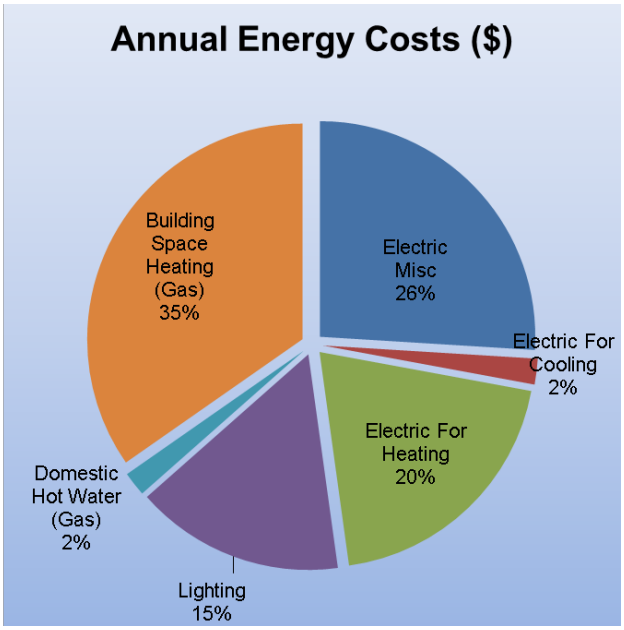


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature of 65°F. The heating degree days are zero for the days when the average temperature exceeds the base temperature. Seen here, the natural gas consumption profile follows the HDD curve, which indicates that the gas usage used for heating correlates with outside temperatures. This is a good sign as natural gas usage and heating is not exceeding HDD or being overused.

The following graphs, pie charts, and table show energy use for Waretown Center Vocational & Technical School based on utility bills for the 12 month period. Note: electrical cost at $42/MMBtu of energy is almost 4 times as expensive as natural gas at $12/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc	442	14%	$18,479	26%	$42
Electric For Cooling	33	1%	$1,371	2%	$42
Electric For Heating	338	11%	$14,162	20%	$42
Lighting	267	8%	$11,159	16%	$42
Domestic Hot Water (Gas)	106	3%	$1,291	2%	$12
Building Space Heating (Gas)	2,030	63%	$24,681	35%	$12
Totals	3,216	100%	$71,143	100%	
Total Electric Usage	1,080	34%	$45,171	63%	$42
Total Gas Usage	2,137	66%	$25,972	37%	$12
Totals	3,216	100%	$71,143	100%	

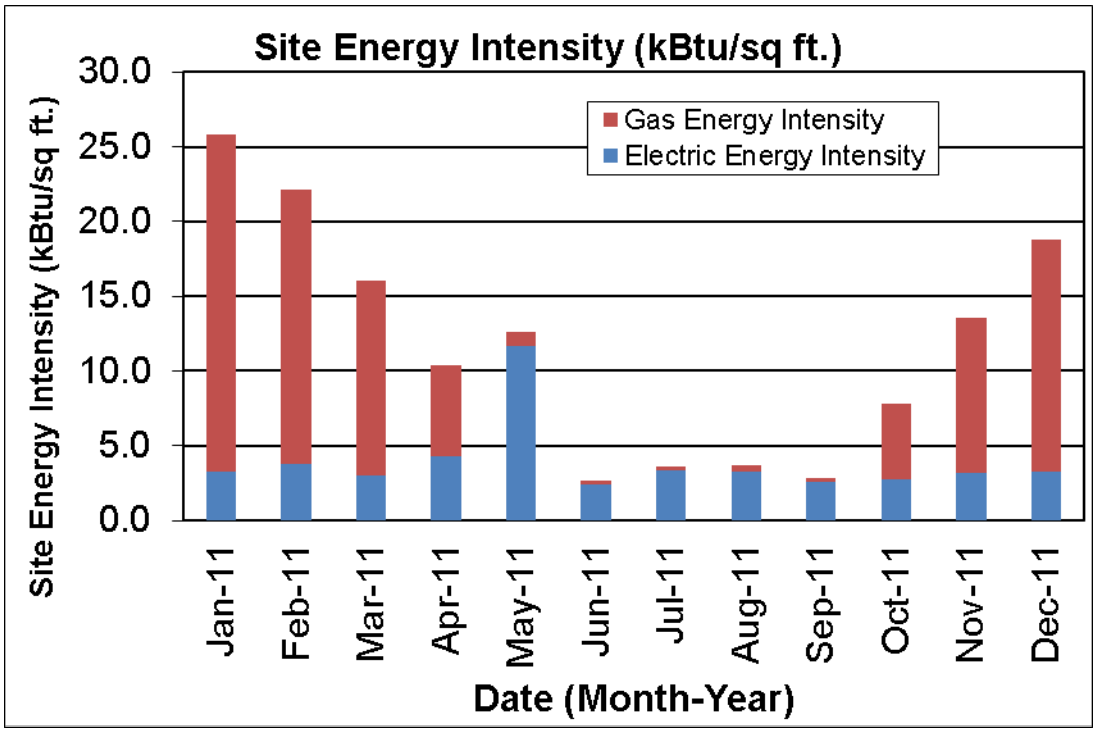




Energy Benchmarking

SWA has entered energy information about Waretown Center in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This school facility is categorized as a "K-12 School" space type. Based on the data entered into the Portfolio Manager software, the building has an Energy Performance Rating of 27 out of a possible 100 points. For reference, a score of 69 is required for LEED for Existing Buildings certification and a score of 75 is required for ENERGY STAR® certification. The Site Energy Utilization Intensity (Site EUI) was calculated to be 134 kBtu/sqft/yr compared to the National Median of 110 kBtu/sqft/yr. This is a 23% difference between the buildings intensity and the national median. See the ECM section for guidance on how to further reduce the building's energy intensity.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar buildings. This 100 point scale determines how well the building performs relative to other buildings across the country, regardless of climate and other differentiating factors. A score of 27 shows the building performs 23% below the national average.



Per the LGEA program requirements, SWA has assisted the OCVTS Public School District to create an ENERGY STAR® Portfolio Manager account and share the Waretown Center Vocational & Technical School information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the OCVTS Public School District (user name of “OceanCountyBOE” with a password of “ocvtsboe”) and TRC Energy Services (user name of “TRC-LGEA”).

SWA has created the Portfolio Manager information for Ocean County Vocational Technical School Board of Education. This information can be accessed at:

URL:https://www.energystar.gov/istar/pmpam/
Username: OceanCountyBOE
Password: ocvtsboe

Tariff analysis

Tariff analysis can help determine if the municipality is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

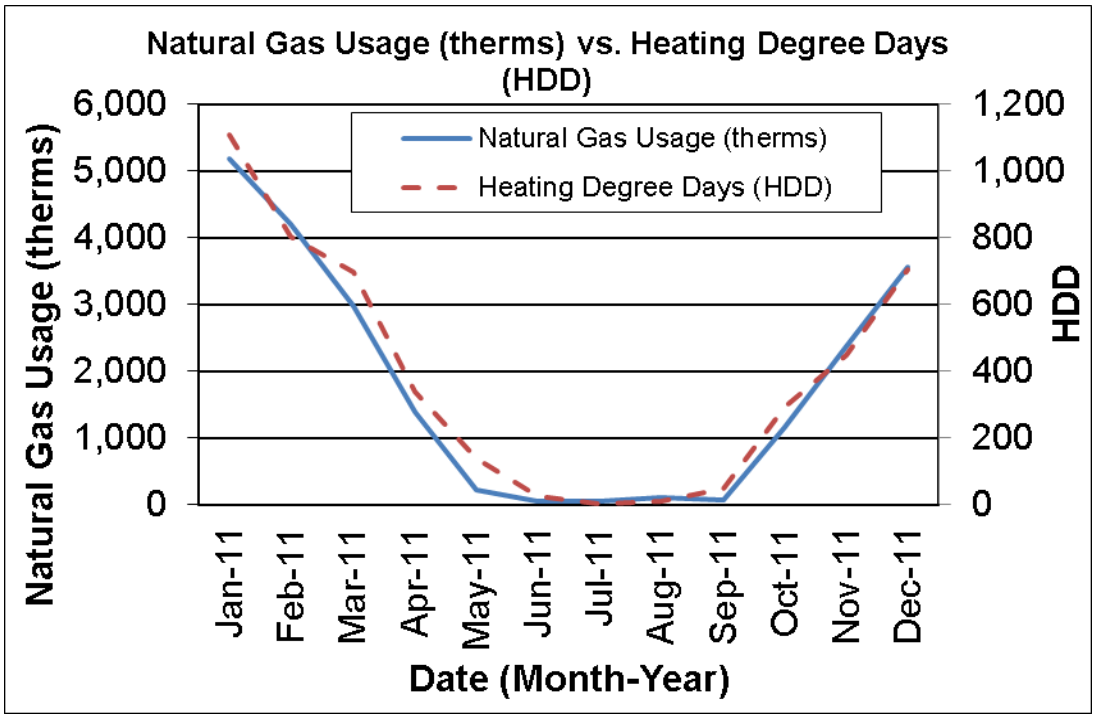
As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the building. Waretown Center Vocational & Technical School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate

based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

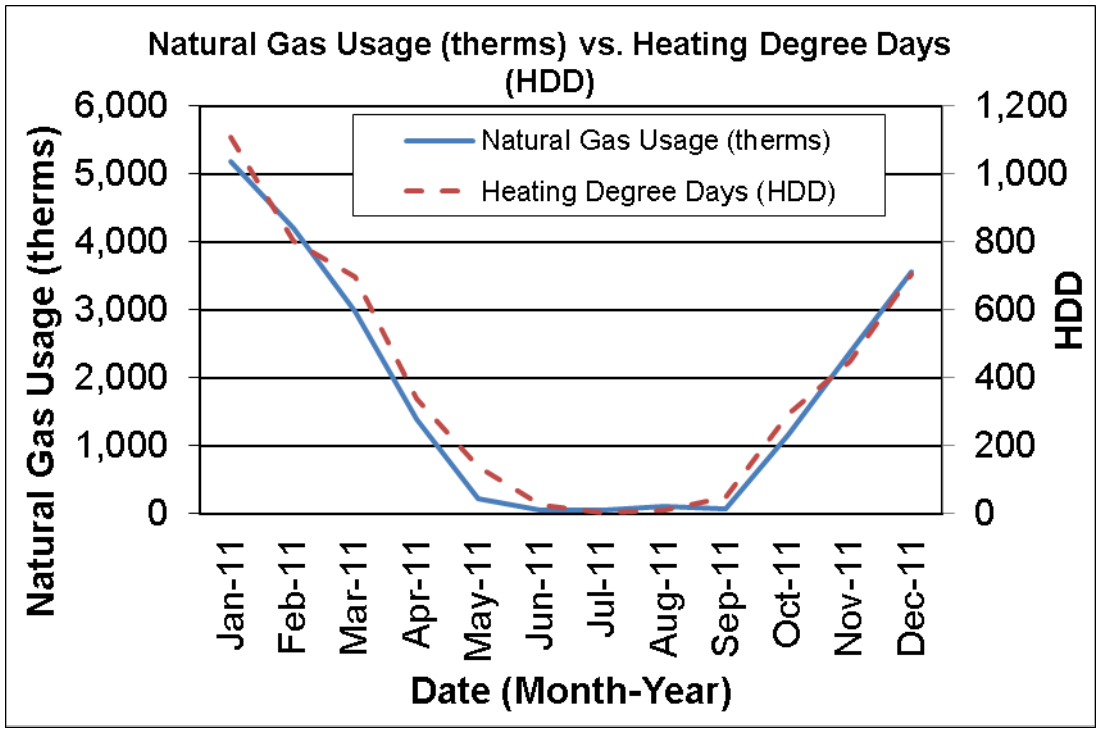
Energy Procurement strategies

Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Waretown Center Vocational & Technical School pays a rate of $0.143/kWh. Waretown Center Vocational & Technical School annual electric utility costs are $2,285 lower, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows rate fluctuations up to 16% over the most recent 12 month period. Electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges and market rate changes.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Waretown Center Vocational & Technical School pays a rate of $1.216/therm. Waretown Center Vocational & Technical School annual natural gas costs are $7,145 lower, when compared to the average estimated NJ commercial utility rates. Natural gas bill analysis shows rate fluctuations up to 85% over the most recent 12 month period. Utility rate fluctuations in the spring and summer months may have been caused by a combination of low usage and the assessment of fixed fees and costs.



SWA recommends that the Waretown Center Vocational & Technical School continue purchasing electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for Waretown Center Vocational & Technical School. Appendix H contains a complete list of third-party energy suppliers for the service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA on Tuesday, April 3, and 2012Wednesday, April 18, 2012, the following data was collected and analyzed.

Building Characteristics

The single-story slab on grade 24,000 square feet OCVTS Waretown Center was built in 1971. It is a rectangular shaped building that houses industrial shops and classrooms. The shops are large garage like rooms where students are able to get hands on experience on different technical trades, such as auto repair and plumbing. Other classrooms include hospitality/basic food, which has a full sized kitchen, and service occupations. Each shop room consists of a bathroom, tool room, locker/dressing area, small classroom, and a small office. In addition to the shop rooms there is a faculty room, main office, nurse's office, principal's office, and a computer lab. The building has undergone several renovations since it was built. In 1994, several pieces of mechanical equipment were replaced. In 1997, the T12 fixtures were replaced with more efficient T8 fixtures. The most recent renovation occurred in 2009, with the replacement of the soffit and fascia.

East Façade

North Façade

West Façade

South Façade

Building Occupancy Profiles

The school's occupancy is approximately 250 students and 25 faculty members, from 6:30 AM to 3:30 PM Monday through Friday. The building stays open till 10:00 PM one night per week during the schools regular sessions. The school is closed on Saturdays and Sundays and for the months of June, July, and August.

Building Envelope

Due to unfavorable weather conditions, no exterior envelope infrared (IR) images were taken during the field audit. Ideal weather conditions include a minimum indoor/outdoor delta-T of 18°F, and no/low wind.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer over concrete block with unconfirmed level of masonry concrete block fill insulation. The interior is predominantly painted CMU (Concrete Masonry Units) and painted gypsum board.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no visible signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

Roof

The building's roof is a flat type with no parapet, over steel decking, with a dark-colored EPDM membrane covered by aggregate BUR (loose light-colored gravel stones). Gravel stops are located along the roofs perimeter to contain the stones. There is a metal ribbed fascia board that surrounds the building. The roof has not been replaced since 1996.

Note: Roof insulation levels could not be visually verified in the field by non-destructive methods.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall fair condition, with a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas.

The following specific roof problem spots were identified:

Deteriorating EPDM and lack of gravel BUR

Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with concrete block foundation walls and no detectable slab edge/perimeter insulation.

Slab and perimeter insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no visible signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains several different types of windows:

1. Combined fixed and awning type windows with a non-insulated aluminum frame, single glazing and interior mini blinds. The windows are located throughout the building in the classrooms and offices.

2. Fixed type windows with a non-insulated frame, single glazing and with no interior or exterior shading devices. The windows are located around the main entrance doors and in some of the shop rooms.

The windows are original to the building. The windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in fair age appropriate condition, with no visible signs of uncontrolled air-leakage issues.

Exterior doors

The buildings contain several different types of exterior doors:

1. Aluminum type exterior doors with single-pane glass panels and a non-insulated frame. They are located at the hallway exits on the exterior side of the vestibules.

2. Fiberglass reinforced polyester type doors with 1” insulated tempered glass. They are located at the emergency exits in shop rooms.

3. Metal doors with an insulated frame. They are located on the interior side of the hallway exit vestibules.

4. Aluminum non-insulated garage doors. They are located in the shop rooms.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with only a no visible signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Mechanical Systems

Heating Ventilation Air Conditioning

All spaces in Waretown Center Vocational & Technical School are mechanically ventilated, heated and cooled. The school contains one mechanical room which houses boilers, a water heater, pumps, compressors and controls. The heating, ventilation, and air conditioning (HVAC) equipment is described below.

Equipment

Heating and ventilation – Two cast iron hot water boilers, located in the boiler room, are used to provide heating to the entire school. The H.B. Smith 350 Mills boilers have capacities of 2,290 MBH and 2,292 MBH, and were installed in 1972. The boilers were originally oil fired and were later converted to burn natural gas. Hot water is delivered throughout the building to various unit ventilators and unit heaters, by two 7.5 HP pumps. The pumps are controlled by a Yaskawa variable frequency drive (VFD) and operate in a lead-lag sequence. Unit ventilators located in the shops and classrooms provide heating and ventilation to the surrounding spaces. Unit ventilators have heating capacities between 23,000 BTU/HR and 143,000 BTU/HR, and flow rates between 750 CFM and 2,000 CFM. Unit heaters provide heat to the corridors, vestibules, and mechanical room, and provide supplemental heating to auto and plumbing shops.

Two H.B. Smith 350 Mills boilers


Typical ceiling mounted unit ventilators (L) and typical wall mounted unit ventilators (R)

Cooling – All spaces are heated, ventilated and cooled. The building does not contain a central cooling plant and therefore each space is cooled using split direct expansion (DX) cooling units and unit ventilators, with the exception of the administrative offices and the evaluation room. Two split-DX units are located on the roof, providing cooling to a classroom and a server room. Two packaged roof top units provide cooling to the administrative offices and the evaluation room. Four units which are also used for heating are connected to separate condensing units located on the North side of the building.


Rooftop unit (L); typical split-DX condensing unit (R)

Condensing units connected to four units

Controls

Boilers and pumps are controlled by a Honeywell control system. The Honeywell system is located in the boiler room and is capable of monitoring outdoor temperature, controlling season mode, controlling the unit ventilators and the administrative office roof top unit. The night setback temperatures for the roof top unit are 55°F for heating in the winter, and 85°F for cooling in the summer, which is based on outside air temperature.

Honeywell control panel

All unit ventilators and packaged units are controlled by non-programmable thermostats located in the zones they serve. Thermostats are generally set for 69°F during the winter and 72°F during the summer; however, occupants are only capable of adjusting the temperatures. Unit ventilators are also equipped with an on/off switch, which shuts off the units fan.

Typical non-programmable thermostats

Domestic Hot Water

A gas-fired domestic hot water (DHW) heater is used to provide hot water to the bathrooms and kitchen. The water heater is a 260 gallon direct gas-fired shell and tube boiler with a capacity of 420,000 BTU/HR. The heater was installed in 1971 and received a burner upgrade when the building switched to natural gas. At the time of the visit, DHW was being sent to the kitchen at 150°F and to the restrooms at 108°F.


Patterson Kelley Domestic Hot Water Heater

Electrical systems

Lighting

See attached lighting schedule in Appendix C for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

Interior Lighting - The primary interior lighting at the Waretown Center Vocational & Technical School is electronically ballasted T8 lamped fixtures. The hallways and classrooms currently have ceiling mounted, ceiling suspended, and recessed parabolic linear 4' T8 lamps. In some of the smaller rooms like the faculty room and faculty

bathrooms, 2' T8 lamps were used. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Typical interior T8 lighting (L); and typical T8 lighting in shop/classrooms (R)

Exit Lights - Exit signs were found to be LED types.

Typical LED exit sign

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of high pressure sodium, CFL fixtures, and one metal halide lamps. Exterior lighting is controlled by both photocells and timers.

Typical high pressure sodium wall pack fixtures.

Appliances and process

SWA has conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines and printers all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.

Installed at the Waretown Center are several refrigerators for food and beverages. The school also has several beverage and snack vending machines, as well as commercial grade refrigerators and freezers located in the kitchen area of the basic foods classroom. There are also a few electric washers, dryers, ovens/ranges, and dishwashers in the service occupation classroom.

Typical refrigerators

Vending machines

Commercial grade Energy Star refrigerators and freezers

Elevators

The Waretown Center only has 1 story and therefore does not contain an elevator.

Other electrical systems

There are currently no other significant energy-impacting electrical systems installed at Waretown Center Vocational & Technical School other than a 35 kW natural gas Onan Emergency Generator located in the boiler room. This Onan emergency generator is operated once per week as a functional test for 30 minutes.

35 kW natural gas generator

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

Existing systems

Currently there are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

Based on utility analysis and a study of roof conditions, the OCVTS Waretown Center facility is a good candidate for a 77 kW Solar Panel installation. See ECM #6 for more information.

Solar Thermal Collectors

Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Wind

Waretown Center is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

Waretown Center Vocational & Technical School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, as well as extensive installation of geothermal wells and pumping equipment.

Combined Heat and Power

Waretown Center Vocational & Technical School is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a constant electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Additionally, the seasonal occupancy schedule of the school is not well suited for a CHP installation.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Recommendations: Energy Conservation Measures

#	Energy Conservation Measures
ECM 1	**Retro-commissioning**
ECM 2	**Retrofit 1 refrigerated vending machines with VendingMiser™ Devices**
ECM 3	**Install 29 new occupancy sensors**
ECM 4	**Retrofit 1 snack vending machines with SnackMiser™ Devices**
ECM 5	**Replace High Pressure Sodium parking lot lighting with 20 new LED fixtures**
ECM 6	**Install 77 kW Solar Photovoltaic system**
ECM 7	**Upgrade 12 High Pressure Sodium fixtures to pulse start Metal Halide fixtures**

In order to clearly present the overall energy opportunities for the building and ease the decision of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the listed ECMs (i.e. lighting change influence on heating/cooling.

ECM #1: Retro-commissioning

Retro-commissioning, or existing building commissioning, is a systematic building investigation process for improving and optimizing a building's operation and maintenance. The process focuses on the building's energy consumption by analyzing equipment such as the HVAC mechanical equipment, related controls and consumption patterns derived from utility and other usage information. Retro-commissioning may not necessarily emphasize bringing the building back to its original intended design specifications if the retro-commissioning team finds that the original specifications no longer apply to existing equipment or building needs. The process may result in recommendations for capital improvements, but its primary intent is to optimize the building systems by equipment tune-up, improved operation and maintenance, and diagnostic testing.

The retro-commissioning process involves obtaining documentation about the facility equipment and its current operation as well as multiple site visits for further review of operating parameters and conditions with the maintenance staff. All major energy consuming systems are diagnosed to determine system operation. The retro-commissioning process can also identify potential capital intensive improvements that can be made to further reduce energy usage and utility cost. Often, the savings associated with the low cost improvements can be used to lower the implementation cost associated with the capital-intensive measures and make the overall package more economically viable.

The goals of RCx include:

- Finding opportunities to reduce energy costs through readily implemented changes to the operation of the building.
- Evaluating set points of equipment and systems with the intent of bringing them to a proper operational state.
- Improving indoor environmental quality (IEQ) thereby reducing occupant complaints and reducing staff time spent on complaint calls.
- Improving equipment reliability through enhanced operation and maintenance procedures.

Project cost:

Estimated project cost: $5,400
Source of cost estimate: Similar projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$4,800	33,619	0	3,949	21.2	$0	$9,600	3	$28,800	0.5	500%	167%	192%	$21,561	103,721

Assumptions: SWA calculated the estimated ECM cost at $0.20/sqft, which is typical of buildings of this size and type.

Rebates/financial incentives:

- There currently are no incentives for this measure at this time.

Please see APPENDIX K for more information on Incentive Programs.

ECM #2: Retrofit 1 refrigerated vending machines with VendingMiser™ Devices

The school currently has one beverage machine which is located in the faculty room. VendingMiser devices are available for conserving energy used by beverage vending machines and coolers. Purchasing new machines is not necessary to reduce operating costs and greenhouse gas emissions. When equipped with the VendingMiser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. VendingMiser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; ensure the product stays cold. The school should request permission to install the devices if the machines are leased.

Installation cost:

Estimated installed cost: $199 (includes $20 of labor)
Source of cost estimate: www.usatech.com and established costs

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$199	1,525	0	0	0.2	$0	$218	12	$2,613	0.9	1,213%	101%	109%	$1,882	2,731

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA determined energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php. See APPENDIX E for savings calculations.

Rebates/financial incentives:

- This measure does not qualify for a rebate or other financial incentives at this time.

Please see APPENDIX K for more information on Incentive Programs.

ECM #3: Install 29 new occupancy sensors

On the days of the site visits, SWA completed a lighting inventory of Waretown Center Vocational & Technical School (see Appendix C). The building contains several areas that could benefit from the installation of occupancy sensors. These areas consisted of various storage rooms, bathrooms and offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced ultra-sonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $5,800 (includes $1,740 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$5,800	16,099	3	0	2.4	$0	$2,302	15	$34,530	2.5	495%	33%	39%	$20,628	28,825

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors ($20 per control)
    - Maximum Incentive Amount: $580
- NJ Clean Energy – Direct Install (Up to 70% of installed costs)

Please see APPENDIX K for more information on Incentive Programs.

ECM #4: Retrofit 1 snack vending machines with SnackMiser™ Devices

SnackMiser devices are now available for conserving energy used by vending machines. Purchasing newer equipment is not necessary to reduce operating costs and greenhouse gas emissions. When equipped with the snack miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. SnackMiser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use 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, the snacks vending miser will sense the presence and immediately power up. The school should request permission to install the devices if the machines are leased.

Installation cost:

Estimated installed cost: $180 (includes $20 of labor)
Source of cost estimate: www.usatech.com and established costs

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$180	366	0	0	0.0	$0	$52	12	$627	3.4	248%	21%	27%	$324	655

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA assumes energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php. See APPENDIX E for savings calculations.

Rebates/financial incentives:

- This measure does not qualify for a rebate or other financial incentives at this time.

Please see APPENDIX K for more information on Incentive Programs.

ECM #5: Retrofit 20 high pressure sodium parking lot lights with LEDs

The exterior lighting is made up of inefficient metal halide fixtures. Aside from having higher energy consumption, these fixtures require frequent lamp and ballast replacements. SWA is recommending LED lamps replacement lamps. For the proposed retrofit, the scope of work involves removing the existing light and ballast and replacing with an LED lamp and ballast. The existing poles and fixtures would be left in tact at the same quantity and height. By retrofitting the existing fixtures, the cost of materials and labor can be reduced. LED technology has advanced greatly in the past 10 years and has long operating lifespans. LED lighting uses considerably less energy than metal halide lights.

Installation cost:

Estimated installed cost: $14,692 (includes $5,692 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$14,693	13,436	3	0	1.9	$1,879	$3,800	5	$19,000	3.9	29	6	9	$2,530	24,057

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:
There are currently no incentives for this measure

Please see APPENDIX K for more information on Incentive Programs.

ECM #6: Install 77 kW Solar Photovoltaic system

Currently, Waretown Center Vocational & Technical School does not use any renewable energy systems. Renewable energy systems such as photovoltaic (PV) panels can be mounted on the building roof facing south which can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, electric demand at a power station is high, due to the amount of air conditioners, lights, and other equipment being used within the region. Demand charges increase to offset the utility's infrastructure cost to provide enough electricity at that given time. Photovoltaic systems offset the amount of electricity used by a building and help to reduce the building's electric demand, resulting in a higher cost savings. Installing a PV system will offset electric demand and reduce annual electric consumption, while utilizing available state incentives. PV systems are modular and readily allow for future expansions.

The size of the system was determined considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation. A commercial multi-crystalline panel has 17.1 square feet of surface area (providing 12.1 watts per square foot). A 77 kW system needs approximately 307 panels which would take up 6,325 square feet. Additionally, PV system installations should be accompanied by an evaluation of the roof's structural stability. The roof is nearing the end of its lifespan, it should be replaced prior to the installation of the PV system (see roof replacement under the Capital Improvement section).

A PV system would reduce the building's electric load and allow more capacity for surrounding buildings as well as serve as an example of energy efficiency for the community. The building is not eligible for a residential 30% federal tax credit. The building owner may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Utility companies in New Jersey buy Solar Renewable Energy Credits (SRECs) at the best market rate. In addition to selling electricity generated by the solar PV system, SRECs are earned every time that 1 MWh or 1,000 kWh are generated from the renewable system. SRECs sales value in NJ have dropped from $670 (November 2011) to $145 (March 2012) which results in a longer payback for the system.

The red rectangle above represents potential space for a PV system installation.

Installation cost:
Net estimated installed cost: $384,800
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
384,800	93,158	77	0	0.0	1,040	81,590	25	2,039,738	4.7	430	17	20	620,080	166,799

Annual Solar PV Cost Savings Breakdown				
Rated Capacity (kW)	77.0			
Rated Capacity (kWh)	93,158			
Annual Capacity Loss	0%			
Year	kWh Capacity	Installation/Maintenance Cost	SRECs	Savings ($)
0		$384,800	$0	
1	93,158	$1,040	$13,508	$25,789.16
2	93,158	$1,040	$13,508	$25,789.16
3	93,158	$1,040	$13,508	$25,789.16
4	93,158	$1,040	$13,508	$25,789.16
5	93,158	$1,040	$13,508	$25,789.16
6	93,158	$1,040	$13,508	$25,789.16
7	93,158	$1,040	$13,508	$25,789.16
8	93,158	$1,040	$13,508	$25,789.16
9	93,158	$1,040	$13,508	$25,789.16
10	93,158	$1,040	$13,508	$25,789.16
11	93,158	$1,040	$13,508	$25,789.16
12	93,158	$1,040	$13,508	$25,789.16
13	93,158	$1,040	$13,508	$25,789.16
14	93,158	$1,040	$13,508	$25,789.16
15	93,158	$1,040	$13,508	$25,789.16
16	93,158	$1,040	$0	$12,281.26
17	93,158	$1,040	$0	$12,281.26
18	93,158	$1,040	$0	$12,281.26
19	93,158	$1,040	$0	$12,281.26
20	93,158	$1,040	$0	$12,281.26
21	93,158	$1,040	$0	$12,281.26

22	93,158	$1,040	$0	$12,281.26
23	93,158	$1,040	$0	$12,281.26
24	93,158	$1,040	$0	$12,281.26
25	93,158	$1,040	$0	$12,281.26
	kWh	Cost	Saving	
Lifetime Total	**2,328,948**	**($384,800)**	**$202,619**	**$509,650**

Table of 12 SREC Values

EY2012 SACP=$658			SREC Quantity		Monthly		Cumulative	
Month	**Year**	**Active kW DC**	**Issued in Month**	**Traded in Month**	**High ($/MWh)**	**Low ($/MWh)**	**# of SRECs Traded**	**Weighted Avg Price ($/MWh)**
Sept	2012							
Aug	2012							
Jul	2012							
Jun	2012							
May	2012							
Apr	2012							
Mar	2012	668,643	60,685	50,701	$635	$100	309,381	$342.56
Feb	2012	629,664	43,636	37,581	$650	$112	258,680	$361.67
Jan	2012	521,987	42,745	50,186	$669	$115	221,099	$373.75
Dec	2011	488,357	40,592	52,716	$658	$115	170,913	$369.46
Nov	2011	443,654	36,897	52,024	$650	$100	118,197	$353.21
Oct	2011	425,798	34,467	34,724	$658	$120	66,173	$403.07
Sept	2011	413,889	45,941	18,412	$675	$50	31,449	$401.90
Aug	2011	395,919	48,535	12,252	$665	$100	13,037	$410.48
July	2011	362,871	37,738	785	Due to low trade volume, the July trades are reported with the cumulative pricing data starting in August.			
	Total		**391,236**	**309,381**				

*The cumulative weighted average price takes into account all of the SRECs that have been traded for all of the months reported. This number can be used to reflect pricing trends. It is calculated based on [(number of SRECs sold at Price A * price A)+(number of SRECs sold at Price B * price B)+...] www.njcleanenergy.com/renewable-energy/project-activity-reports/srec-pricing/srec-pricing

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. Installed costs were estimated at $5/Watt installed. SRECs are currently evaluated at $145/MWh based on the lowest SREC value in the past 12 months. SWA projected physical dimensions based on a typical Polycrystalline solar panel. PV systems are sized based on 77 kW and physical dimensions and efficiencies for an array will differ depending of the specific solar panel selection (W/sq ft.).

Rebates/financial incentives:

- NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold

or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $13,508/year, based on $145/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Please see APPENDIX K for more information on Incentive Programs.

ECM #7: Upgrade 12 High Pressure Sodium fixtures to pulse start Metal Halide fixtures

The existing exterior lighting contains standard probe start High Pressure Sodium (HPS) lamps. SWA recommends replacing the higher wattage HPS fixtures with pulse start MH lamps which produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:
Net estimated installed cost: $17,544 (includes $9,649 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$17,544	14,255	3	0	2.1	$105	$2,144	15	$32,160	8.2	83	6	9	$7,446	25,524

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:
(Possibility)NJ Clean Energy - SmartStart - Metal Halide with pulse start $25 per fixture - Maximum incentive amount is $500

Please see APPENDIX K for more information on Incentive Programs.

Proposed Further Recommendations

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. Capital improvements may also constitute equipment that is currently being operated beyond its useful lifetime. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available. SWA recommends the following capital improvements for the OCVTS Waretown Center.

- The Waretown Center roof is made up of a dark-colored EPDM membrane covered by aggregate BUR (loose light-colored gravel stones). The roof is nearing the end of its useful life, as it was last replaced in 1996. Based on similar roof types, this roof surface is beyond the manufacturer's warranty and is recommended to be replaced. SWA recommends upgrading the existing roof with a roof with high solar reflectance and increased insulation. Replacing the roof will result in some energy savings; however, due to the high capital cost, this measure will not be justified based on energy savings alone. The roof should be replaced prior to installing a PV system. Accurate energy savings calculations would require the use of advanced building modeling software, which is outside the scope of this project. SWA estimates the roof replacement to cost $197,562 based on the total footprint of the building.

- Replace End-of-Life RTUs and Condensing Units – During the audit, a complete mechanical inventory was completed and all equipment was evaluated for replacement. In total, there were two split-dx systems and two rooftop units that were found to be operating beyond their useful lifetime and are recommended for replacement as they fail. Equipment to be replaced consists of equipment located on the roof that was installed during the renovations in 1994 and 1995. SWA recommends that this equipment is replaced with appropriately sized units of the same capacity with the highest efficiency achievable. In addition to a better performing unit, new units will also utilize R-410A refrigerant that has a smaller negative impact on the environment compared to R-22 that is no longer being manufactured and has been phased out completely as of January 1, 2010. Due to the high replacement costs, the increased efficiency will not provide an attractive payback. Accurate energy savings calculations would require the use of advanced building modeling software, which is outside the scope of this project. Implementation costs and units to be replaced are presented below:

Replacement Component	Installed Cost
Replacement of one 1 ton split-dx system	$3,312
Replacement of one ¾ ton split-dx system	$2,518
Replacement of one 7.5 ton rooftop unit	$13,153
Replacement of one 25 ton rooftop unit	$38,713
Total Replacement Costs	**$57,696**

- Replace existing hot water heater with two condensing water heaters – During the field audit, SWA inspected the existing Domestic Hot Water (DHW) heater. There is currently one natural gas heater that produces DHW for the entire building. The expected service life of a DHW heater is 10-13 years. Consideration should be given to replace the heater with more efficient type and tank as part of a capital improvement plan. The associated pump appears to be operating adequately and has fractional horsepower, so replacement would not yield significant energy savings and would not provide and attractive payback period.

New energy-efficient gas-fired storage water heaters are a good, cost-effective replacement option for old water heaters if a gas line is in your building. They have higher levels of insulation around the tank and one-way valves where pipes connect to the tank, substantially reducing standby heat loss. Newer super-efficient "condensing" and "near-condensing" gas water heaters save much more energy compared to traditional models. For safety as well as energy efficiency, fuel-burning water heaters should be installed with sealed combustion ("direct-vented" or "power-vented). Sealed combustion means that outside air is brought in directly to the water heater and exhaust gases are vented directly outside, keeping combustion totally separate from the house air. SWA estimates the removal of the old heater, and installation of two condensing boilers to be $13,889. The combined capacity of the two condensing boilers is assumed to be equivalent to the existing water heater.

- Replace existing unit ventilators and unit heaters – The existing unit ventilators have reached their end of useful life. Some unit ventilators are rarely turned on, due to the loud fan noise and damaged fins on the heating coils. SWA recommends replacing the existing unit ventilators and heaters which would provide more comfort to each space they serve, and would operate more efficiently. Accurate energy savings calculations would require the use of advanced building modeling software, which is outside the scope of this project. Implementation costs and units to be replaced are presented below:

Replacement Component	Installed Cost
Replacement of six 750 CFM unit ventilators	$25,654
Replacement of four 1500 CFM unit ventilators	$27,307
Replacement of four 2000 CFM unit ventilators	$45,755
Replacement of five 16 MBH unit heaters	$2,876
Replacement of two 43 MBH unit heaters	$1,953
Replacement of one 210 MBH unit heater	$2,798
Demolition of existing unit ventilators and heaters	$12,906
Total Replacement Costs	**$119,906**

- Replace existing windows with Energy Star certified windows – The entire building is currently outfitted with windows that have single glazing, no low-E coating and are original to the building. Newer Energy Star certified windows provide better insulation and reduce solar gain with a low-E coating. SWA recommends replacing the windows with double or triple glazing, low-E coating and an insulated frame, which may reduce the heating and cooling loads. Ideally the windows should be Energy Star certified, which meets strict requirements for energy saving performance. The project is estimated to cost $43,644. Accurate energy savings calculations would require the use of advanced building modeling software, which is outside the scope of this project.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Check and adjust timers and time clocks monthly – During the site visit, several exterior lights were observed to be left on during the day due to incorrect timer settings. In addition to exterior

lights, several time clocks that control HVAC equipment were also left on due to incorrect time settings. During power surges or outages, digital clocks are reset and require setting to ensure that timers remain accurate.

- Replace motors with NEMA premium efficiency models – SWA observed several motors for hot water distribution that were not NEMA premium efficiency models and are beyond their useful lifetime. Operating non-NEMA premium efficiency motors with a VFD can shorten the life of the motor. Since these motors have been maintained well, SWA recommends replacing them with high efficiency models as part of routine O&M the next time that they fail.

- Replace existing thermostats with electronic thermostats – The existing thermostats are non-programmable or electronic. SWA recommends replacing the thermostats with electronic or programmable models, capable of limiting zone temperature by +/- 2°F. By limiting the temperature control, employees will not be able to create drastic temperature variations between each zone.

- Review VFD installation – At the time of the visit, SWA was not able to verify if unit ventilators, and heating and ventilation units were equipped with two-way valves. Based on the building drawings, the units are equipped with three-way valves. VFDs are capable of saving energy by varying the motor speed, provided that the system is equipped with two-way valves. SWA recommends the OCVTS Waretown Center review the installation of the VFD and the valves at the heating equipment. This review can be conducted as part of retro-commissioning as recommended earlier in this report.

- Unclog and maintain all roof drains/scuppers.

- Provide water-efficient fixtures and controls – Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

- Inspect and replace cracked/ineffective caulk.

- Inspect and maintain sealants at all windows for airtight performance.

- Inspect and maintain weather-stripping around all exterior doors and roof hatches.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. More information can be found in the “Products” section of the ENERGY STAR® website at: http://www.energystar.gov.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize energy use. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

APPENDIX A: EQUIPMENT LIST

Inventory

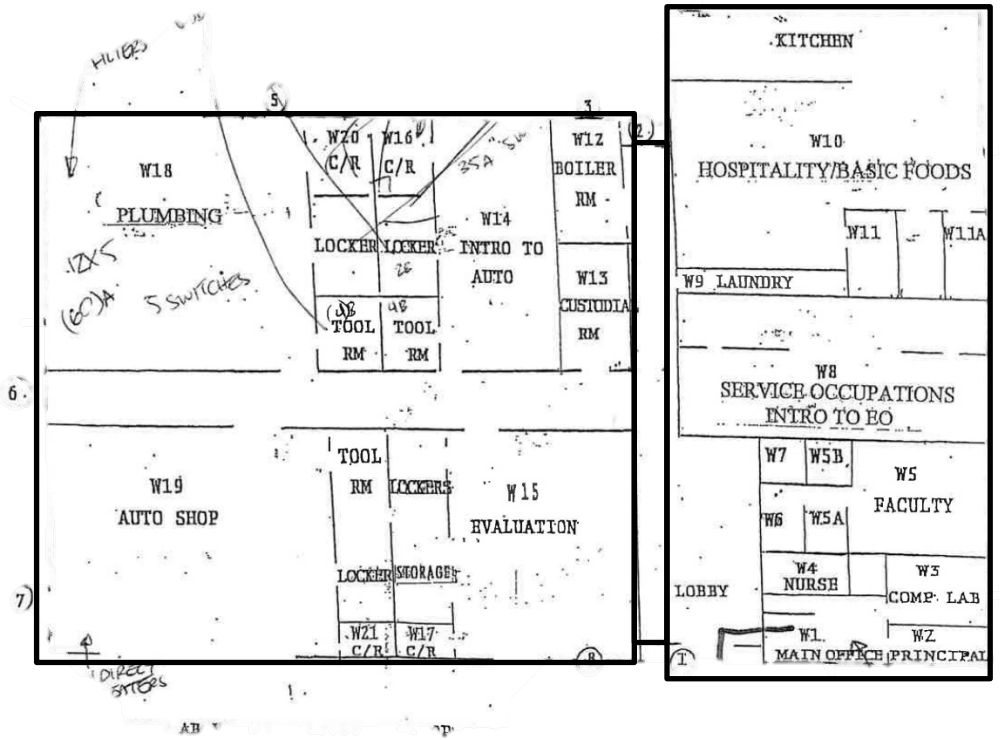
Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Trane Gas Unit Heater, Normal Input 40.4 MBH, 1004 CFM, 1/8 HP	Auto Mechanics	Trane No. 70 WF	Natural Gas	Auto Shop	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 40.4 MBH, 1004 CFM, 1/8 HP	Auto Mechanics	Trane No. 70 WF	Natural Gas	Plumbing	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 15 MBH, 200 CFM, 110 Watts	Corridor Vestibule	Trane E46/A0-04	Natural Gas	Corridor Vestibule 55	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 15 MBH, 200 CFM, 110 Watts	Corridor	Trane E46/A0-04	Natural Gas	Corridor 55	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 15 MBH, 200 CFM, 110 Watts	Gallery	Trane E46/A0-04	Natural Gas	Gallery	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 15 MBH, 200 CFM, 110 Watts	Gallery	Trane E46/A0-04	Natural Gas	Gallery	1972	0%
Heating	Trane Gas Unit Heater, Normal Input 15 MBH, 200 CFM, 110 Watts	Corridor	Trane E46/A0-04	Natural Gas	Corridor 55	1972	0%
Heating	Unit Heater, 209,100 BTU/HR, 4,200 CFM	Mechanical Room	Mestek, Model #HS-280S, Serial #H85561-96	Natural Gas	Mechanical Room	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 23,00 BTUH, 1/6 HP,	Planning Area 42	Trane No. RAUA 35	Electric	Planning Area 42	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 23,00 BTUH, 1/6 HP,	Planning Area 49	Trane No. RAUA 35	Electric	Planning Area 49	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 23,00 BTUH, 1/6 HP,	Planning Area 6	Trane No. RAUA 35	Electric	Planning Area 6	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 23,00 BTUH, 1/6 HP,	Planning Area 34	Trane No. RAUA 35	Electric	Planning Area 34	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 23,00 BTUH, 1/6 HP,	Planning Area 27	Trane No. RAUA 35	Electric	Planning Area 27	1972	0%
Heating & Ventilation	Unit Ventilator, 1500 CFM, 75,000 BTUH, 1/6 HP,	Service Occupations	Trane No. RAUA 40	Electric	Service Occupations	1972	0%
Heating & Ventilation	Unit Ventilator, 1500 CFM, 74,000 BTUH, 1/6 HP,	Hospitality/Basic Foods	Trane No. RAUA 35	Electric	Hospitality/Basic Foods	1972	0%
Heating & Ventilation	Unit Ventilator, 1500 CFM, 74,000 BTUH, 1/6 HP,	Hospitality/Basic Foods	Trane No. RAUA 35	Electric	Hospitality/Basic Foods	1972	0%
Heating & Ventilation	Unit Ventilator, 1500 CFM, 52,000 BTUH, 1/6 HP,	Service Occupations	Trane No. RAUA 40	Electric	Service Occupations	1972	0%
Heating & Ventilation	Unit Ventilator, 2000 CFM, 143,000 BTUH, 1/3 HP	Evaluation	Trane No. RAUA 40	Electric	Evaluation	1972	0%

Heating & Ventilation	Unit Ventilator, 2000 CFM, 143,000 BTUH, 1/3 HP	Into to Auto	Trane No. RAUA 40	Electric	Into to Auto	1972	0%
Heating & Ventilation	Unit Ventilator, 2000 CFM, 143,000 BTUH, 1/3 HP	Auto Shop	Trane No. RAUA 40	Electric	Auto Shop	1972	0%
Heating & Ventilation	Unit Ventilator, 2000 CFM, 143,000 BTUH, 1/3 HP	Plumbing	Trane No. RAUA 40	Electric	Plumbing	1972	0%
Heating & Ventilation	Unit Ventilator, 2000 CFM, 143,000 BTUH, 1/3 HP	Building Trades 33	Trane No. RAUA 40	Electric	Building Trades 33	1972	0%
Heating & Ventilation	Unit Ventilator, 750 CFM, 31,000 BTUH, 1/6 HP	Auto Shop	Trane No. RAUA 37	Electric	Auto Shop	1972	0%
Heating	H.B. Smith 350 Mills Hot Water Boiler, 2,290 MBH Input	Mechanical Room	Serial #5971	Natural Gas	Mechanical Room	1972	0%
Heating	H.B. Smith 350 Mills Hot Water Boiler, 2,292 MBH Input Capacity, 3,640 MBH SV Capacity	Mechanical Room	N/A	Natural Gas	Mechanical Room	1972	0%
Heating	Burner, 2 HP, 3450 RPM, 3 Phase	Mechanical Room	Marathon Electric, Model #3E56T34D5577BP	Electric	Boiler	1994	10%
Heating	Burner, 2 HP, 3450 RPM, 3 Phase	Mechanical Room	Marathon Electric, Model #3E56T34D5577BP	Electric	Boiler	1994	10%
Heating	Distribution pump, 1725 RPM, 7.5 HP	Mechanical Room	A.O. Smith, Model #SC-251U-KAA-6-32614	Electric	Boiler	1994	10%
Heating	Distribution pump, 1760 RPM, 7.5 HP NEMA Nom. Eff. 91.7%	Mechanical Room	Marathon Electric, Model #SC-251U-KAA-6-32614	Electric	Boiler	1994	10%
Domestic Hot Water	DHW, 420,000 BTU/HR, 260 Gallon	Mechanical Room	The Patterson Kelley Co - 300-3/2T, Serial #NB24857	Natural Gas	Whole Building	1971	0%
Pneumatics	Compressor	Mechanical Room	Quincy, Model #QC03008D00439	Electric	Whole Building	2005	53%
Pneumatics	Compressor, Baldor motor, 1750 RPM, 7.5 HP, NEMA Nom. Eff. 88.5%	Mechanical Room	Saylor-Beall, Model #X-745-200, Serial #7-27-FOS, Baldor Cat. #M3311T, Spec 36B103T848H1	Electric	Whole Building	2005	53%
Generator	Onan, 35 kW	Mechanical Room	Onan, Model #35EK, Serial #F960610213	Natural Gas	Whole Building	1994	0%
Heating & Cooling	Packaged roof top unit, 2 compressors, 1 condenser, R-22, 3/4 HP, 7.5 ton	Roof	Arcoaire, Model #PAAB090N2HA RAMA75H001A, Serial #L945036054	Electric	Administrative Offices	1994	0%
Heating & Cooling	Packaged roof top unit, 2 Compressors 208/3/60, R-22, Heating 54 kW, 25 ton	Roof	Trane #TCH151B300DB, Serial #K441025550	Electric	Marine Trades	1995	0%

Cooling	Split Air Conditioner, Indoor unit	Marine Trades Planning Area	Sanyo, Model #KS1822, Serial #0115652	Electric	Marine Trades Planning Area	1995	0%
Cooling	Split Type AC Condenser, 208/1/60, 17,000 BTU/HR Cooling, R-22	Roof	Sanyo, Model #C1822, Serial #0098353	Electric	Classroom	1995	0%
Cooling	Split Type AC Condenser, 208/1/60, 9,000 BTU/HR Cooling, R-22	Roof	Sanyo, Model #C0911, Serial #0111653	Electric	Classroom	1995	0%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

Appendix B: Waretown Floor Plan



Appendix C: Lighting Study

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Fac. Room (5)	Recessed Parabolic	E	2'T8	7	3	17	Sw	9	261	6	399	937	C	Recessed Parabolic	2'T8	E	OS	7	3	17	7	261	6	399	703	0	234	234
2	1	Mens Bathroom (5)	Recessed Parabolic	E	2'T8	1	2	17	Sw	9	261	4	38	89	C	Recessed Parabolic	2'T8	E	OS	1	2	17	7	261	4	38	67	0	22	22
3	1	Womens Bathroom (5)	Recessed Parabolic	E	2'T8	1	2	17	Sw	9	261	4	38	89	C	Recessed Parabolic	2'T8	E	OS	1	2	17	7	261	4	38	67	0	22	22
4	1	Nurse Office (4)	Recessed Parabolic	E	4'T8	2	2	32	Sw	9	261	10	148	348	C	Recessed Parabolic	4'T8	E	OS	2	2	32	7	261	10	148	261	0	87	87
5	1	Main Office (1)	Recessed Parabolic	E	4'T8	10	4	32	Sw	9	261	20	1,480	3,477	C	Recessed Parabolic	4'T8	E	OS	10	4	32	7	261	20	1480	2607	0	869	869
6	1	Principal (2)	Recessed Parabolic	E	4'T8	4	4	32	Sw	9	261	20	592	1,391	C	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	20	592	1043	0	348	348
7	1	Computer Lab (3)	Recessed Parabolic	E	4'T8	7	4	32	Sw	9	261	20	1,036	2,434	C	Recessed Parabolic	4'T8	E	OS	7	4	32	7	261	20	1036	1825	0	608	608
8	1	Bathroom	Recessed Parabolic	E	2'T8	1	2	17	Sw	9	261	4	38	89	C	Recessed Parabolic	2'T8	E	OS	1	2	17	7	261	4	38	67	0	22	22
9	1	Entrance 1	Ceiling Mounted	S	CFL	4	2	13	Sw	24	365	0	104	911	N/A	Ceiling Mounted	CFL	S	Sw	4	2	13	24	365	0	104	911	0	0	0
10	1	Entrance 2	Ceiling Mounted	S	CFL	2	1	13	Sw	24	365	0	26	228	N/A	Ceiling Mounted	CFL	S	Sw	2	1	13	24	365	0	26	228	0	0	0
11	1	Hallway	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
12	1	Hallway	Recessed Parabolic	E	4'T8	8	4	32	Sw	9	261	20	1,184	2,781	N/A	Recessed Parabolic	4'T8	E	Sw	8	4	32	9	261	20	1184	2781	0	0	0
13	1	Hallway	Recessed Parabolic	E	4'T8	13	4	32	Sw	9	261	20	1,924	4,519	N/A	Recessed Parabolic	4'T8	E	Sw	13	4	32	9	261	20	1924	4519	0	0	0
14	1	Hallway	Ceiling Mounted	S	CFL	2	1	13	Sw	24	365	0	26	228	N/A	Ceiling Mounted	CFL	S	Sw	2	1	13	24	365	0	26	228	0	0	0
15	1	Entrance 3	Ceiling Mounted	S	CFL	2	1	13	Sw	24	365	0	26	228	N/A	Ceiling Mounted	CFL	S	Sw	2	1	13	24	365	0	26	228	0	0	0
16	1	Trophy Case	Recessed Parabolic	E	4'T8	4	2	32	Sw	9	261	10	296	695	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	9	261	10	296	695	0	0	0
17	1	Laundry Rm (9)	Recessed Parabolic	E	4'T8	1	4	32	Sw	9	261	20	148	348	C	Recessed Parabolic	4'T8	E	OS	1	4	32	7	261	20	148	261	0	87	87
18	1	Food/Kitchen (10)	Recessed Parabolic	E	4'T8	35	2	32	Sw	9	261	10	2,590	6,084	N/A	Recessed Parabolic	4'T8	E	Sw	35	2	32	9	261	10	2590	6084	0	0	0
19	1	Womens Locker (11A)	Recessed Parabolic	E	4'T8	4	2	32	Sw	9	261	10	296	695	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	9	261	10	296	695	0	0	0
20	1	Mens Locker (11B)	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	9	261	10	74	174	0	0	0
21	1	Storage (11)	Ceiling Mounted	E	4'T8	3	2	32	Sw	9	261	10	222	521	N/A	Ceiling Mounted	4'T8	E	Sw	3	2	32	9	261	10	222	521	0	0	0
22	1	Classroom (11)	Recessed Parabolic	E	4'T8	28	2	32	Sw	9	261	10	2,072	4,867	C	Recessed Parabolic	4'T8	E	OS	28	2	32	7	261	10	2072	3650	0	1217	1217
23	1	Office (11)	Recessed Parabolic	E	4'T8	4	2	32	Sw	9	261	10	296	695	C	Recessed Parabolic	4'T8	E	OS	4	2	32	7	261	10	296	521	0	174	174
24	1	Office (11)	Recessed Parabolic	E	4'T8	3	2	32	Sw	9	261	10	222	521	C	Recessed Parabolic	4'T8	E	OS	3	2	32	7	261	10	222	391	0	130	130
25	1	Bathroom (11)	Recessed Parabolic	E	2'T8	2	2	17	Sw	9	261	4	76	179	C	Recessed Parabolic	2'T8	E	OS	2	2	17	7	261	4	76	134	0	45	45
26	1	Boiler Room (12)	Recessed Parabolic	E	4'T8	12	2	32	Sw	9	261	10	888	2,086	N/A	Recessed Parabolic	4'T8	E	Sw	12	2	32	9	261	10	888	2086	0	0	0
27	1	Shop (15)	Recessed Parabolic	E	4'T8	33	3	32	Sw	9	261	15	3,663	8,604	C	Recessed Parabolic	4'T8	E	OS	33	3	32	7	261	15	3663	6453	0	2151	2151
28	1	Shop (15)	Ceiling Mounted	S	CFL	1	1	13	Sw	24	365	0	13	114	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	24	365	0	13	114	0	0	0
29	1	Classroom (17)	Recessed Parabolic	E	4'T8	8	2	32	Sw	9	261	10	592	1,391	C	Recessed Parabolic	4'T8	E	OS	8	2	32	7	261	10	592	1043	0	348	348
30	1	Office (17)	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
31	1	Bathroom (17)	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
32	1	Shop (19)	Recessed Parabolic	E	4'T8	92	2	32	Sw	9	261	10	6,808	15,992	C	Recessed Parabolic	4'T8	E	OS	92	2	32	7	261	10	6808	11994	0	3998	3998
33	1	Shop (19)	Ceiling Mounted	S	CFL	1	1	13	Sw	24	365	0	13	114	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	24	365	0	13	114	0	0	0
34	1	Tool Room (19)	Recessed Parabolic	E	4'T8	4	2	32	Sw	9	261	10	296	695	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	9	261	10	296	695	0	0	0
35	1	Bathroom	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
36	1	Office	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
37	1	Classroom	Recessed Parabolic	E	4'T8	8	2	32	Sw	9	261	10	592	1,391	C	Recessed Parabolic	4'T8	E	OS	8	2	32	7	261	10	592	1043	0	348	348
38	1	Shop (18)	Ceiling Mounted	E	4'T8	60	2	32	Sw	9	261	10	4,440	10,430	C	Ceiling Mounted	4'T8	E	OS	60	2	32	7	261	10	4440	7822	0	2607	2607
39	1	Tool Room (18)	Ceiling Mounted	E	4'T8	4	2	32	Sw	9	261	10	296	695	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	9	261	10	296	695	0	0	0
40	1	Bathroom (18)	Ceiling Mounted	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Ceiling Mounted	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
41	1	Upper Tool Rm (18)	Ceiling Mounted	E	4'T8	6	2	32	Sw	9	261	10	444	1,043	N/A	Ceiling Mounted	4'T8	E	Sw	6	2	32	9	261	10	444	1043	0	0	0
42	1	Classroom (20)	Ceiling Suspended	E	4'T8	8	2	32	Sw	9	261	10	592	1,391	C	Ceiling Suspended	4'T8	E	OS	8	2	32	7	261	10	592	1043	0	348	348
43	1	Office (20)	Recessed Parabolic	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
44	1	Shop (14)	Ceiling Mounted	E	4'T8	35	2	32	Sw	9	261	10	2,590	6,084	C	Ceiling Mounted	4'T8	E	OS	35	2	32	7	261	10	2590	4563	0	1521	1521
45	1	Tool Room (14)	Ceiling Mounted	E	4'T8	4	2	32	Sw	9	261	10	296	695	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	9	261	10	296	695	0	0	0
46	1	Bathroom (14)	Ceiling Mounted	E	4'T8	1	2	32	Sw	9	261	10	74	174	C	Ceiling Mounted	4'T8	E	OS	1	2	32	7	261	10	74	130	0	43	43
47	1	Classroom (16)	Ceiling Mounted	E	4'T8	6	2	32	Sw	9	261	10	444	1,043	C	Ceiling Mounted	4'T8	E	OS	6	2	32	7	261	10	444	782	0	261	261
48	1	Office (16)	Ceiling Suspended	E	4'T8	8	2	32	Sw	9	261	10	592	1,391	C	Ceiling Suspended	4'T8	E	OS	8	2	32	7	261	10	592	1043	0	348	348
49	1	Custodial (13)	Ceiling Suspended	E	4'T8	8	2	32	Sw	9	261	10	592	1,391	N/A	Ceiling Suspended	4'T8	E	Sw	8	2	32	9	261	10	592	1391	0	0	0
50	Ext	Exterior	Wallpack	S	HPS	4	1	250	T	11	261	50	1,200	3,445	PSMH	Wallpack	PSMH	S	T	4	1	150	11	261	30	720	2067	1378	0	1378
51	Ext	Exterior	Wallpack	S	HPS	7	1	200	T	11	261	40	1,680	4,823	PSMH	Wallpack	PSMH	S	T	7	1	125	11	261	25	1050	3015	1809	0	1809
52	Ext	Exterior	Landscape	S	MH	1	1	400	T	11	261	112	512	1,470	PSMH	Landscape	PSMH	S	T	1	1	250	11	261	50	300	861	609	0	609
53	Ext	Exterior	Pole Mounted	S	HPS	4	1	250	T	11	261	50	1,200	3,445	LED	Pole Mounted	LED	S	T	4	1	60	11	261	6	264	758	2687	0	2687
54	Ext	Exterior	Pole Mounted	S	HPS	16	1	250	T	11	261	50	4,800	13,781	LED	Pole Mounted	LED	S	T	16	1	60	11	261	6	1056	3032	10749	0	10749
Totals:						**490**	**111**	**2,702**				**760**	**46,434**	**115,451**						**490**	**111**	**1,997**			**575**	**40,432**	**82,120**	**17,232**	**16,099**	**33,331**

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	24,000		
Average Power Cost ($/kWh)	0.1430		
Exterior Lighting	**Existing**	**Proposed**	**Savings**

Exterior Annual Consumption (kWh)	26,964	9,733	**17,232**
Exterior Power (watts)	9,392	3,390	**6,002**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	88,486	72,387	**16,099**
Lighting Power (watts)	37,042	37,042	**0**
Lighting Power Density (watts/SF)	1.54	1.54	**0.00**
Estimated Cost of Fixture Replacement ($)	23,486		
Estimated Cost of Controls Improvements ($)	5,800		
Total Consumption Cost Savings ($)	**6,665**		

LEGEND			
Lamp Type		**Controls**	
CFL	Compact Fluorescent	T	Autom. Timer
Inc	Incadescent	BL	Bi-Level
LED	Light Emitting Diode	Ct	Contact
MH	Metal Halide	M	Daylight & Motion
MV	Mercury Vapor	DLSw	Daylight & Switch
PSMH	Pulse Start Metal Halide	DL	Daylight Sensor
HPS	High Pressure Sodium	DSw	Delay Switch
LPS	Low Pressure Sodium	D	Dimmer
Fl	Fluorescent	MS	Motion Sensor
4'T8	4 Feet long T8 Linear Lamp	MSw	Motion& Switch
4'T8 U-shaped	4 Feet long T8 U-shaped Lamp	N	None
4'T5	4 Feet long T5 Linear Lamp	OS	Occupancy Sensor
Ballast Type		OSCM	Occupancy Sensor Ceiling Mounted
E	Electronic	PC	Photocell
M	Magnetic	Sw	Switch
S	Self		

APPENDIX D: SOLAR PV SHADING ANALYSIS

Site Report

Report Name	Waretown Center3
Report Date	5/21/2012 4:35:56 PM
Declination	0d 00m
Location	WARETOWN, NJ 08758
Lat/Long	39.788 / -74.247
Weather Station	McGuire AFB, NJ, Elevation: 148 Feet, (40.017/-74.600)
Site distance	25 Miles
Report Type	PV
Array Type	Fixed
Tilt Angle	39.79 deg
Ideal Tilt Angle	39.79 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.143 ($/KWH)
Panel Make	<not specified>
Panel Model	<not specified>
Panel Count	370
DC Rate (per panel)	208.0 W
Total System Size	76,960.0 W
Inverter Make	<not specified>
Inverter Model	<not specified>
Inverter Count	1
Derate Method	System Setting
Derate Factor	0.800
Layout Configuration	SinglePicture
Layout Point Count	1

Notes: [None]

System Picture Layout

Layout Type Single Picture
Layout Point Count 1

Report generated by SolarPathfinder Assistant Version 4.1.27.0. http://www.solarpathfinder.com
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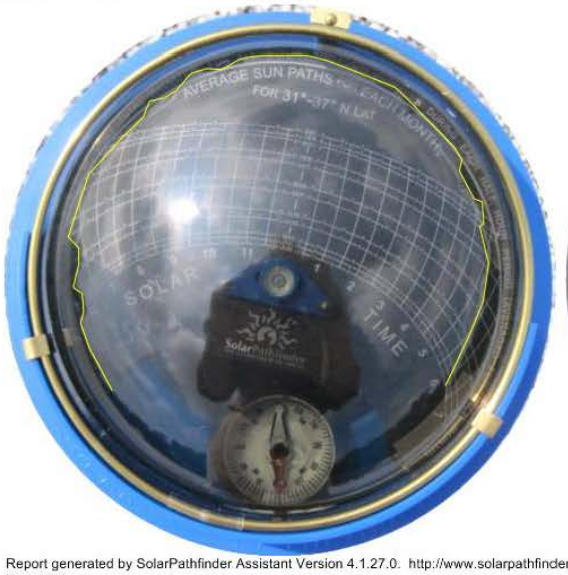
Solar Site Analysis Report

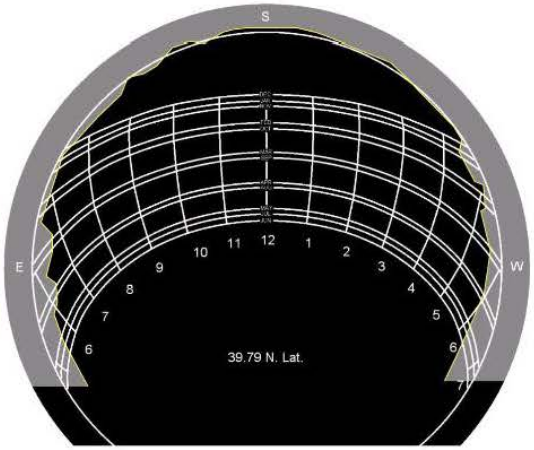
Image File IMG_6136.jpg

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.79	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=39.79 KWH/m^2 /day	Actual AC Energy (KWH) w/ shading Azimuth=180.00 Tilt=39.79	Actual AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.79	Ideal AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.79	Solar Cost Savings 0.143 ($/KWH)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=39.79	Actual Site Efficiency % Azimuth=180.0 Tilt=39.79	Ideal Site Efficiency % Azimuth=180.0 Tilt=39.79
January	99.31%	3.85	7,509.80	7,550.00	7,550.00	$1,073.90	99.27 %	99.27 %	99.27 %
February	100.00%	3.54	6,252.00	6,252.00	6,252.00	$894.04	100.00 %	99.58 %	99.58 %
March	99.83%	5.48	10,108.00	10,110.00	10,110.00	$1,445.44	99.90 %	99.90 %	99.90 %
April	99.21%	4.97	8,789.26	8,801.00	8,801.00	$1,256.86	99.18 %	99.18 %	99.18 %
May	99.10%	4.69	8,310.87	8,313.00	8,313.00	$1,188.45	99.10 %	99.10 %	99.10 %
June	99.08%	5.15	8,381.66	8,385.00	8,385.00	$1,198.58	99.14 %	98.95 %	98.95 %
July	99.01%	4.64	7,733.96	7,736.00	7,736.00	$1,105.96	98.92 %	98.92 %	98.92 %
August	98.71%	4.41	7,603.29	7,615.00	7,615.00	$1,087.27	98.92 %	98.92 %	98.92 %
September	98.76%	5.20	8,787.28	8,822.00	8,822.00	$1,256.58	98.68 %	98.68 %	98.68 %
October	100.00%	5.23	9,381.00	9,382.00	9,382.00	$1,341.48	100.00 %	99.68 %	99.68 %
November	100.00%	3.00	5,485.00	5,485.00	5,485.00	$784.36	99.92 %	99.92 %	99.92 %
December	99.96%	2.60	4,815.80	4,816.00	4,816.00	$688.66	99.93 %	99.93 %	99.93 %
Totals	**99.42%**	**52.76**	**93,157.93**	**93,267.00**	**93,267.00**	**$13,321.58**	**99.41 %**	**99.34 %**	**99.34 %**
	Unweighted Yearly Avg	**Effect: 99.30% Sun Hrs: 4.40**					**Unweighted Yearly Avg**	**Unweighted Yearly Avg**	**Unweighted Yearly Avg**

Notes: [None]





Report generated by SolarPathfinder Assistant Version 4.1.27.0. http://www.solarpathfinder.com
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Summary Report

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.79	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=39.79 KWH/m ^{2} /day	Actual AC Energy (KWH) w/ shading Azimuth=180.00 Tilt=39.79	Actual AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.79	Ideal AC Energy (KWH) w/o shading Azimuth=180.0 Tilt=39.79	Solar Cost Savings 0.143 ($/KWH)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=39.79	Actual Site Efficiency % Azimuth=180.0 Tilt=39.79	Ideal Site Efficiency % Azimuth=180.0 Tilt=39.79
January	99.31%	3.85	7,509.80	7,550.00	7,550.00	$1,073.90	99.27 %	99.27 %	99.27 %
February	100.00%	3.54	6,252.00	6,252.00	6,252.00	$894.04	100.00 %	99.58 %	99.58 %
March	99.83%	5.48	10,108.00	10,110.00	10,110.00	$1,445.44	99.90 %	99.90 %	99.90 %
April	99.21%	4.97	8,789.26	8,801.00	8,801.00	$1,256.86	99.18 %	99.18 %	99.18 %
May	99.10%	4.69	8,310.87	8,313.00	8,313.00	$1,188.45	99.10 %	99.10 %	99.10 %
June	99.08%	5.15	8,381.66	8,385.00	8,385.00	$1,198.58	99.14 %	98.95 %	98.95 %
July	99.01%	4.64	7,733.96	7,736.00	7,736.00	$1,105.96	98.92 %	98.92 %	98.92 %
August	98.71%	4.41	7,603.29	7,615.00	7,615.00	$1,087.27	98.92 %	98.92 %	98.92 %
September	98.76%	5.20	8,787.28	8,822.00	8,822.00	$1,256.58	98.68 %	98.68 %	98.68 %
October	100.00%	5.23	9,381.00	9,382.00	9,382.00	$1,341.48	100.00 %	99.68 %	99.68 %
November	100.00%	3.00	5,485.00	5,485.00	5,485.00	$784.36	99.92 %	99.92 %	99.92 %
December	99.96%	2.60	4,815.80	4,816.00	4,816.00	$688.66	99.93 %	99.93 %	99.93 %
Totals	**99.41%**	**52.76**	**93,157.93**	**93,267.00**	**93,267.00**	**$13,321.58**	**99.41 %**	**99.34 %**	**99.34 %**
	Unweighted Yearly Avg	**Effect: 99.30% Sun Hrs: 4.40**					**Unweighted Yearly Avg**	**Unweighted Yearly Avg**	**Unweighted Yearly Avg**

Notes: [None]

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APPENDIX E: EnergyMiser Calculations

EnergyMisers

VendingMiser® CoolerMiser™ SnackMiser™ PlugMiser™ VM2iQ® CM2iQ®

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.
Note: To calculate for CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)	$0.143
Facility Occupied Hours per Week	80
Number of Cold Drink Vending Machines	1
Number of Non-refrigerated Snack Machines	1
Power Requirements of Cold Drink Machine (Watts; 400 typical)	400
Power Requirements of Snack Machine (Watts; 80 typical)	80
VendingMiser® VM150 Price (for cold drink machines)	$199.00
SnackMiser™ SM150 Price (for snack machines)	$180.00

Calculate Savings!

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	3494	1969	1525	44%
Cost of Operation	$499.70	$281.58	$218.12	44%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	699	333	366	52%
Cost of Operation	$99.94	$47.59	$52.35	52%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	4193	2302	1891	45%
Cost of Operation	$599.64	$329.17	$270.47	45%

Total Project Cost	Break Even (Months)
$379	16.82

Estimated Five Year Savings on ALL Machines = $1,352.36

Estimated Five Year Return on Investment = 257%

APPENDIX F: COST WORKS COST ESTIMATES

423 Well Mills Road
Waretown,
New Jersey, 08758
Year 2012 Quarter 2

Date: 11-Jun-12

Unit Detail Report

OCVTS-Waretown Center

Cost Estimate Report
CostWorks
RSMeans

Prepared By:
Dan Carmichael
Steven Winter Associates Inc

LineNumber			Description	Quantity	Unit	Total Incl O&P	Ext. Total Incl O&P
Division 07 Thermal and Moisture Protection							
070150101600			Roof Coatings, reflective, white, elastomeric, 50 sf/gallon	1,140.00	Gal.	$17.31	$19,733.40
075113202600			Built-up roofing systems, asphalt flood coat, smooth surface, 4 plies #15 asphalt felt, mopped	570.00	Sq.	$311.98	$177,828.60
Division 07 Subtotal							**$197,562.00**
Division 08 Openings							
080505200240			Window demolition, aluminum, to 25 S.F.	48.00	Ea.	$48.23	$2,315.04
085313300380			Windows, solid vinyl double hung, premium quality, double insulated glass, 3'-6" x 6"-0", including grill, J finish, low E, exterior jambs	28.00	Ea.	$508.84	$14,247.52
085313400260			Windows, vinyl casement, 2 lite, 47" x 47", including grill, J finish, low E, exterior jambs	20.00	Ea.	$708.77	$14,175.40
Division 08 Subtotal							**$30,737.96**
Division 23 Heating, Ventilating, and Air Conditioning (HVAC)							
230505100100			Air conditioner, split unit air conditioner, 3 ton, selective demolition	2.00	Ea.	$754.44	$1,508.88
230505100350			Boiler, gas and or oil or solid, 160 thru 2000 MBH, selective demolition	1.00	Ea.	$3,990.40	$3,990.40
230505100360			Boiler, gas and or oil or solid, 2100 thru 4500 MBH, selective demolition	2.00	Ea.	$6,390.88	$12,781.76
230505102730			Heating and ventilating unit, selective demolition	23.00	Ea.	$561.15	$12,906.45
235216240220			Condensing boilers, cast iron, gas fired, natural or LP, packaged, DOE MBH output, 194 MBH, (82.7%) AFUE, includes standard controls, circulator, trim	2.00	Ea.	$4,949.25	$9,898.50
235223302100			Boiler, gas/oil combination, cast iron, steam, gross output, 2040 MBH, includes burners, controls and insulated jacket, packaged	1.00	Ea.	$37,927.50	$37,927.50
235223302120			Boiler, gas/oil combination, cast iron, steam, gross output, 2450 MBH, includes burners, controls and insulated jacket, packaged	1.00	Ea.	$42,382.50	$42,382.50
237433101150			Rooftop air conditioner, single zone, electric cool, gas heat, 7.5 ton cooling, 170 MBH heating, includes, standard controls, curb and economizer	1.00	Ea.	$11,467.90	$11,467.90
237433101150	A		Air conditioning, for upgrade to SEER 14 add	1.00		$1,685.00	$1,685.00

LineNumber			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
237433101210			Rooftop air conditioner, single zone, electric cool, gas heat, 25 ton cooling, 450 MBH heating, includes, standard controls, curb and economizer	1.00	Ea.	$33,213.20	$33,213.20
237433101210	A		Air conditioning, for upgrade to SEER 14 add	1.00		$5,500.00	$5,500.00
238126100120			Split ductless system, cooling only, single zone, wall mount, 3/4 ton cooling	1.00	Ea.	$1,511.41	$1,511.41
238126100120	A		Air conditioning, for upgrade to SEER 14 add	1.00		$152.00	$152.00
238126100140			Split ductless system, cooling only, single zone, wall mount, 1-1/2 ton cooling	1.00	Ea.	$2,287.71	$2,287.71
238126100140	A		Air conditioning, for upgrade to SEER 14 add	1.00		$270.00	$270.00
238219200080			Heating and ventilating unit, classroom type, heating/cooling coils, 750 CFM, 2 tons cooling, includes filter and standard controls	6.00	Ea.	$5,467.48	$32,804.88
238219200080	A		Heating and ventilating unit, classroom type, heating/cooling coils, for no cooling, deduct	-1.00	Ea.	$1,191.75	$-7,150.50
238219200140			Heating and ventilating unit, classroom type, heating/cooling coils, 1500 CFM, 4 tons cooling, includes filter and standard controls	4.00	Ea.	$8,518.70	$34,074.80
238219200140	A		Heating and ventilating unit, classroom type, heating/cooling coils, for no cooling, deduct	-1.00	Ea.	$1,691.87	$-6,767.48
238219200160			Heating and ventilating unit, classroom type, heating/cooling coils, 2000 CFM, 5 tons cooling, includes filter and standard controls	5.00	Ea.	$11,263.55	$56,317.75
238219200160	A		Heating and ventilating unit, classroom type, heating/cooling coils, for no cooling, deduct	-1.00	Ea.	$2,112.61	$-10,563.05
238239164416			Hydronic heating, unit heater, propeller, horizontal flow, 115 V, hot water, 60Deg.F entering air, 16 MBH	5.00	Ea.	$575.28	$2,876.40
238239164520			Hydronic heating, unit heater, propeller, vertical flow, 115 V, hot water, 60Deg.F entering air, 43 MBH	2.00	Ea.	$976.62	$1,953.24
238239164560			Hydronic heating, unit heater, propeller, vertical flow, 115 V, hot water, 60Deg.F entering air, 210 MBH	1.00	Ea.	$2,797.60	$2,797.60
Division 23 Subtotal							**$283,826.85**

APPENDIX G: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps are no longer being produced for commercial and industrial applications.

- As of **January 1, 2012** 100 watt incandescent bulbs have been phased out in accordance with the Energy Independence and Security Act of 2007.

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

- As of **January 1, 2013** 75 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning

cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

HCFC (Hydrochlorofluorocarbons):

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

APPENDIX H: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for Atlantic City Electric Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com

Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for NJNG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.com

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX I: GLOSSARY AND METHOD OF CALCULATIONS

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measures (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

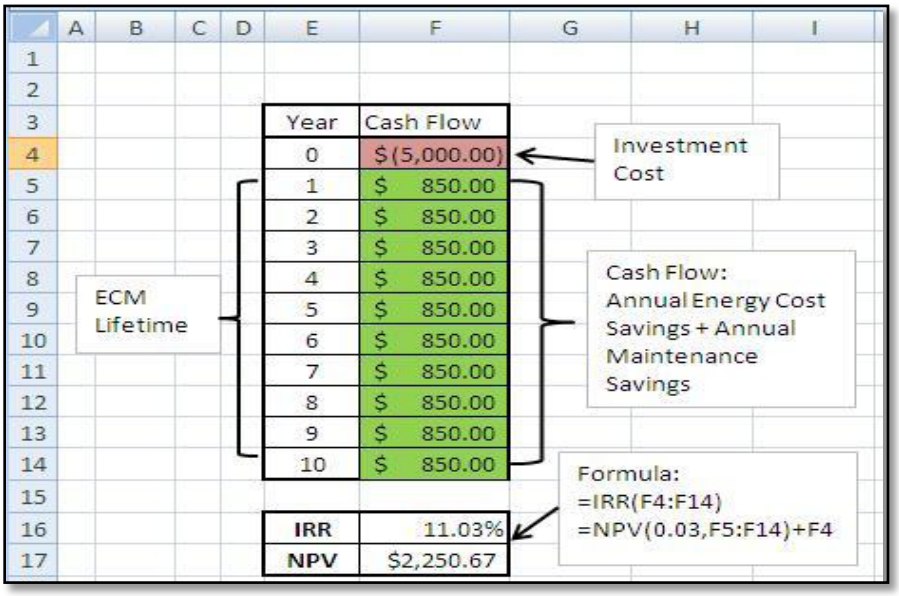
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV (rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $145/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $145/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial Equipment Life Span

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

APPENDIX J: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
OCVTS - Waretown Center

Building ID: 3130247
For 12-month Period Ending: December 31, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 08, 2012

Facility
OCVTS - Waretown Center
423 Wells Mills Rd.
Waretown, NJ 08527

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1971
Gross Floor Area (ft^2): 24,000

Energy Performance Rating[2] (1-100) 27

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,079,557
Natural Gas (kBtu)[4]	2,136,600
Total Energy (kBtu)	3,216,157

Energy Intensity[4]	
Site ($kBtu/ft^2/yr$)	134
Source ($kBtu/ft^2/yr$)	243

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	267

Electric Distribution Utility
Jersey Central Power & Light Co [FirstEnergy Corp]

National Median Comparison	
National Median Site EUI	110
National Median Source EUI	199
% Difference from National Median Source EUI	22%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[5] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12 month period.
4. Values represent energy intensity, annualized to a 12 month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX K: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures, and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

Energy Provider Incentives

- **South Jersey Gas** - Offers financing up to $100,000 on the customer's portion of project cost through private lender. In addition to available financing, it provides matching incentive on gas P4P incentives #2 and #3 up to $100,000 (not to exceed total project cost).

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2011 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC, and other equipment with energy efficient alternatives. The program pays **up to 70%** of the retrofit costs, including equipment cost and installation costs. Each project is limited to $75,000 in incentives.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 150 kW** within 12 months of applying (the 150 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to $25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas

and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Atlantic City Electric –** Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of $5,000 per customer.

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install or visit the utility web sites.

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

Energy Provider Incentives
- **South Jersey Gas –** Program to finance projects up to $25,000 not covered by incentive
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
  PSE&G - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Combined Heat and Power (CHP)

Energy Provider Incentives

- South Jersey Gas - Provides additional incentive of $1.00/watt up to $1,000,000 on top of NJCEP incentive.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG.

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.

APPENDIX L: ENERGY CONSERVATION MEASURES

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Retro-commissioning	4,800	none at this time	4,800	33,619	0	3,949	21.2	0	9,600	3	28,800	0.5	500	167	192	21,561	103,721
2	Retrofit 1 refrigerated vending machine with a VendingMiser™ device	199	none at this time	199	1,525	0	0	0.2	0	218	12	2,613	0.9	1,213	101	109	1,882	2,731
3	Install 29 occupancy sensors	6,380	580	5,800	16,099	3	0	2.4	0	2,302	15	34,530	2.5	495	33	39	20,628	28,825
4	Retrofit 1 vending machine with a SnackMiser™ device	180	0	180	366	0	0	0.1	0	52	12	627	3.4	248	21	27	324	655
5	Retrofit 20 high pressure sodium parking lot lights with LEDs	14,693	0	14,693	13,436	3	0	1.9	1,879	3,800	5	19,000	3.9	29	6	9	2,530	24,057
6	Install 77 kW Solar Photovoltaic system	384,800	0	384,800	93,158	77	0	13.2	1,040	81,590	25	2,039,738	4.7	430	17	20	620,080	166,799
7	Upgrade 12 High Pressure Sodium fixtures to pulse start MH	18,044	500	17,544	14,255	3	0	2.1	105	2,144	15	32,160	8.2	83	6	9	7,446	25,524

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

APPENDIX M: METHOD OF ANALYSIS

Assumptions and tools

Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.