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March 8, 2011

Local Government Energy Program
Energy Audit Report

City of Summit

Fire Department
396 Broad Street
Summit, 07901

Project Number: LGEA74

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EXECUTIVE SUMMARY

The Summit Fire Department is a two-story building with a partial basement comprising a total conditioned floor area of 16,443 square feet. The original structure was built in 1901 with additions/renovations in 1948, 1968 and 1995. The following chart provides an overview of current energy usage in the building based on the analysis period of July 2009 through June 2010:

Table 1: State of Building-Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	173,037	16,324	N/A	$48,098	137.0	2,223
Proposed	147,127	12,801	N/A	$33,910	108.4	1,782
Savings	25,910	3,523	N/A	$14,188*	26.8	441
% Savings	15%	22%	N/A	29%	20%	20%
Proposed Renewables	35,400	Includes SRECs		$26,767	7.3	121
*Includes operation and maintenance savings						

There may be energy procurement opportunities for the Summit Fire Department to reduce annual electric utility costs, which are $2,249 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Fire Department in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. The resulting Site Energy Use Intensity is 137.0kBtu/sq ft yr, which is higher than the average comparable building by 76%.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	$9,323	1.6	$15,253	64,346
5-10 Year	$660	8.8	$5,813	6,177
>10 year	$4,206	16.7	$70,156	14,707
Total	$14,188	6.4	$91,222	85,230
Renewables	$26,767	7.0	$187,500	63,384

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 7 cars from the roads each year or the equivalent of planting 208 trees to offset the annual CO2 emissions generated.

Further Recommendations: Other recommendations to increase building efficiency pertaining to capital improvements and operations and maintenance are (with additional information in the Proposed Further Recommendations section):

- Capital Improvements
  - Install NEMA Premium motors when replacements are required
  - Replace storage and bathroom exhaust fans

- Operations and Maintenance
  - Thoroughly and evenly insulate space above the ceiling tiles and plug all penetrations
  - Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
  - Provide weather-stripping/air-sealing
  - Provide water-efficient fixtures and control

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Summit. Based on the requirements of the LGEA program, Summit must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $1,567 (or 25% of $6,266).

Financial Incentives and Other Program Opportunities

The table below summarizes the recommended next steps that the City of Summit can take to achieve greater energy efficiency and reduce operating expenses.

Table 3: Next Steps for the Fire Department

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Upgrade (6) Thermostats to Programmable Thermostats	Direct Install
Install (23) new CFL Fixtures	Direct Install
Install (1) New T5 fixture	SmartStart, Direct Install
Replace (6) Old Engine Bay Hydronic and Steam Ceiling Hung heaters with (6) 60,000 Btu/hr Infrared Heaters	SmartStart, Direct Install
Install (4) new T8 Fixtures	Smart Start, Direct Install
Install (36) Lighting Occupancy Sensors	Smart Start, Direct Install
Replace old Refrigerator with an Energy Star® Model	N/A
Install a 30kW Solar Photovoltaic Rooftop System	SRECs
Install (12) new Pulse Start Metal Halide Fixtures	Smart Start, Direct Install
Replace Old Boiler and HVAC System with (2) Condensing Furnaces and High Efficiency AC Condensers	Smart Start, Direct Install

There are various incentive programs that the City of Summit could apply to lower the installed ECM costs. SWA recommends the following programs, contingent upon available funding:

- **New Jersey Clean Energy Pay for Performance** - Three phase incentive plan:
  - Develop plan to reduce current energy use by 15%: receive up to 50% of annual energy costs
  - Install measures per plan: receive up to $0.13 per kWh saved and $1.45 per therm saved
  - Benchmark energy savings for a year: receive up to $0.09/kWh saved & $1.05/therm
- **Direct Install 2010 Program**: Commercial buildings with peak electric demand below 100kW can receive up to 60% of installed cost of energy saving upgrades. The 100kW threshold does not apply for LGEA projects that are also receiving EECBG funding. Program incentives are capped at $50,000 per building and $250,000 per customer per year.
- **SmartStart**: Most of energy savings equipment and design measures have moderate incentives under this program.

- **Renewable Energy Incentive Program**: Receive up to $0.75/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by PV renewable energy, receive a credit between $475 and $600.
- **Utility Sponsored Programs**: See available programs with JCP&L https://www.firstenergycorp.com/JCP_L/index.html and PSE&G http://www.pseg.com/environment2008/wyd/community/community.jsp
- **Energy Efficiency and Conservation Block Grant Rebate Program**: Provides up to $20,000 per local government toward energy saving measures; http://njcleanenergy.com/EECBG

Please refer to Appendix F for further details.

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, Summit 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 38-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 Fire Department at 396 Broad Street, Summit, 07901. The process of the audit included facility visits on July 29 and August 5, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, 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 City of Summit to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Fire Department.

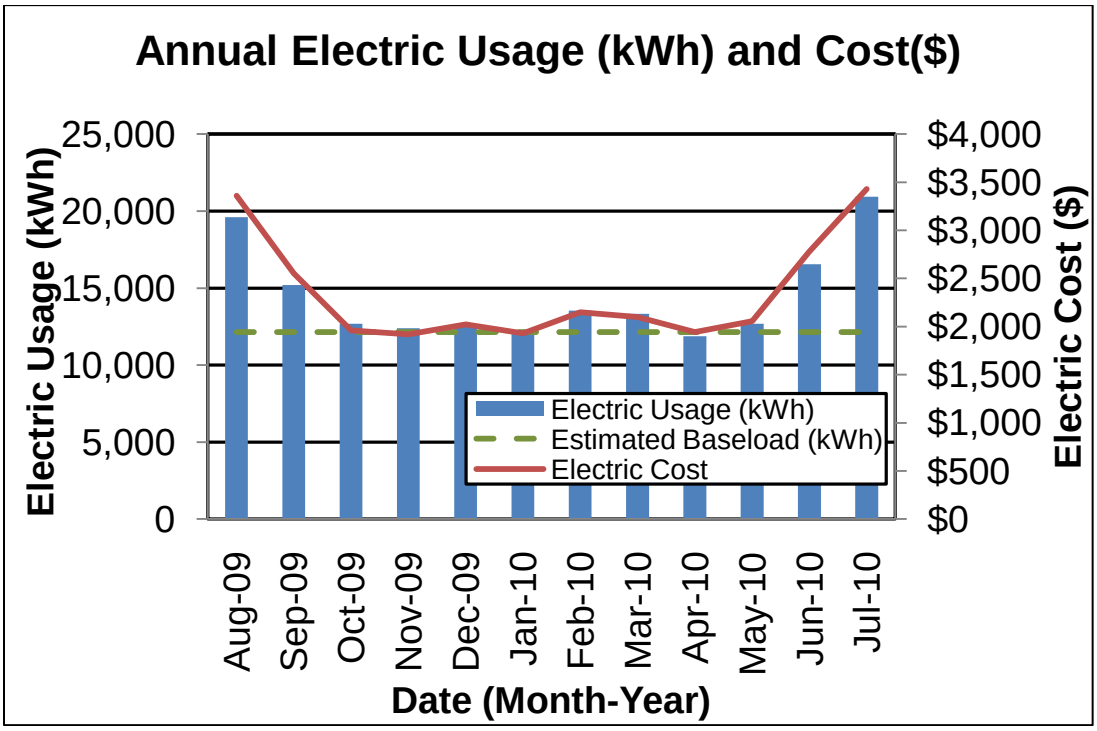
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from July 2009 through June 2010 that were received from the utility companies supplying the Fire Department with electric and natural gas. A 12 month period of analysis from July 2009 through June 2010 was used for all calculations and for purposes of benchmarking the building.

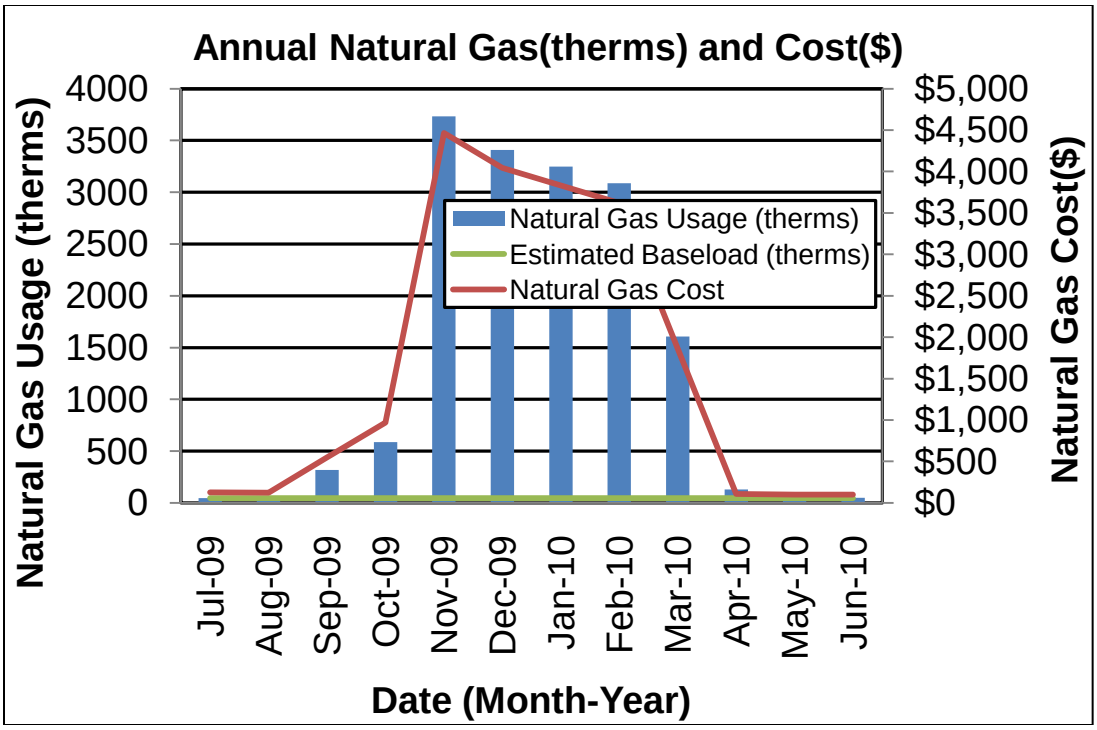
Electricity - The Fire Department is currently served by one electric meter. The Fire Department currently buys electricity from JCP&L at **an average aggregated rate of $0.163/kWh**. The Fire Department purchased **approximately 173,037 kWh, or $28,190 worth of electricity,** in the previous year. The average monthly demand was 32.0 kW and the annual peak demand was 40.4 kW.

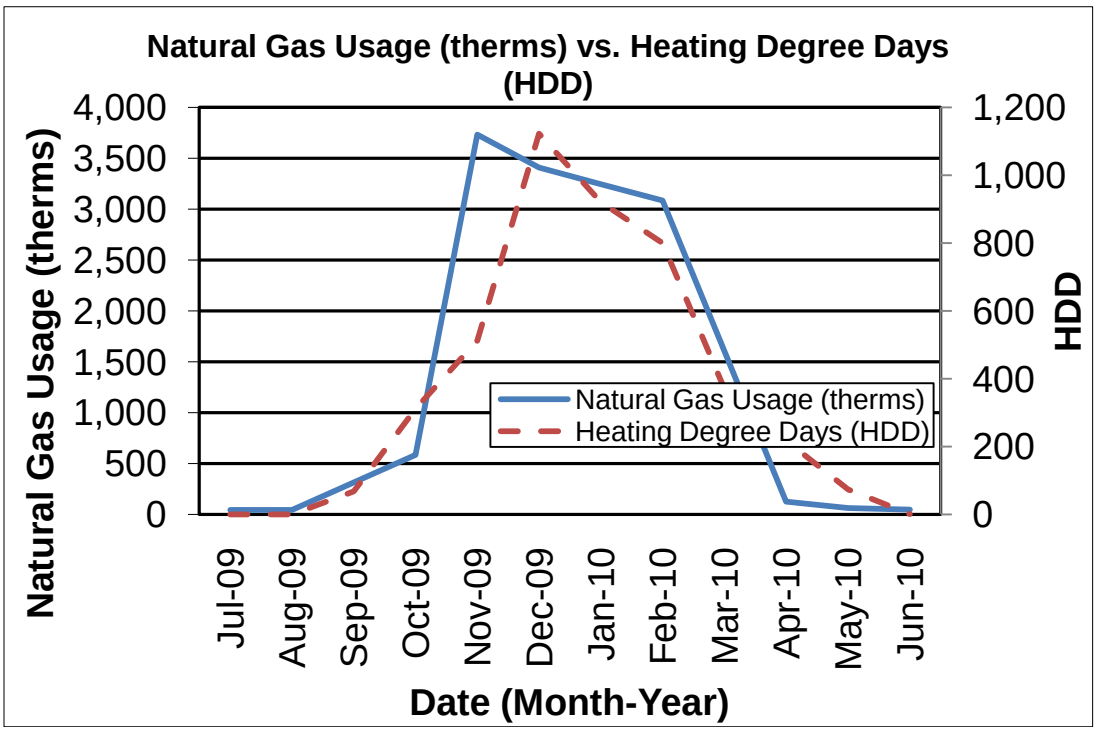
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base-load or minimum electric usage required to operate the Fire Department.



Natural gas - The Fire Department is currently served by one meter for natural gas. The Fire Department currently buys natural gas from PSE&G at **an average aggregated rate of $1.219/therm**. The Fire Department purchased **approximately 16,324 therms, or $19,907 worth of natural gas,** in the previous year.

The following chart shows the monthly natural gas usage and costs. The green line represents the approximate base-load or minimum natural gas usage required to operate the Fire Department.

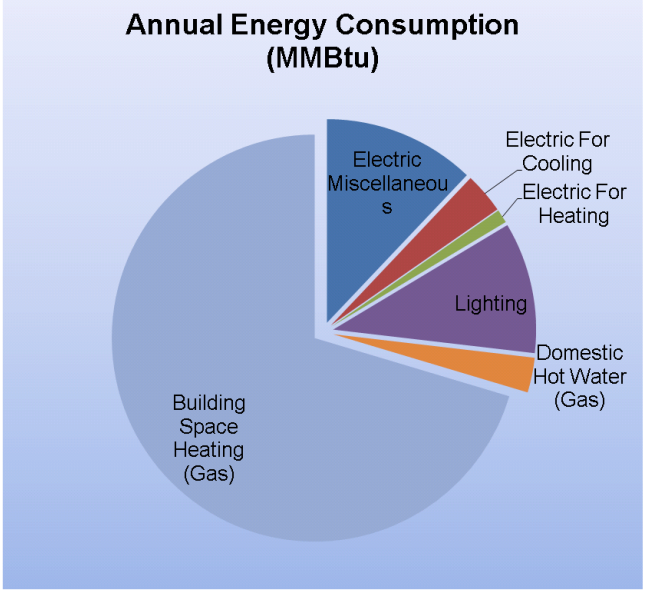


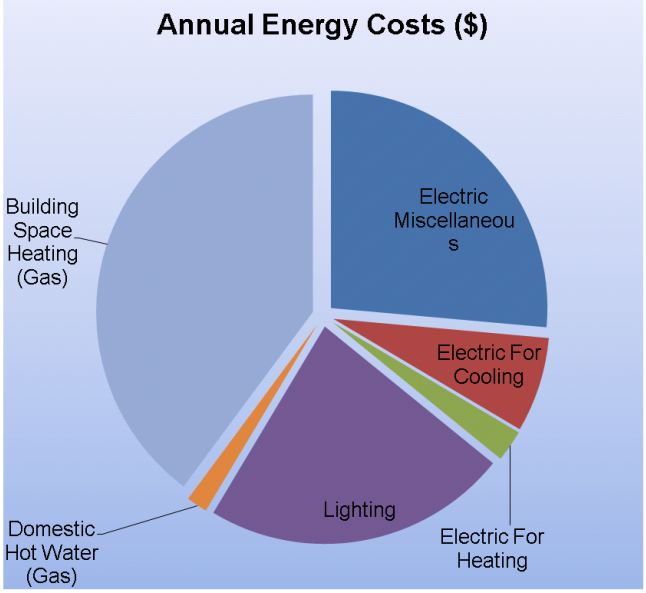


The previous chart shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit.

The following graphs, pie charts, and table show energy use for the Fire Department based on utility bills for the 12 month period. Note: electrical cost at $48MMBtu of energy is 4 times as expensive as natural gas at $12/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	270	12%	$12,888	27%	48
Electric For Cooling	72	3%	$3,455	7%	48
Electric For Heating	15	1%	$736	2%	48
Lighting	233	10%	$11,113	23%	48
Domestic Hot Water (Gas)	62	3%	$753	2%	12
Building Space Heating (Gas)	1,571	71%	$19,154	40%	12
Totals	2,223	100%	$48,098	100%	
Total Electric Usage	590	27%	$28,191	59%	48
Total Gas Usage	1,632	73%	$19,907	41%	12
Totals	2,223	100%	$48,098	100%	

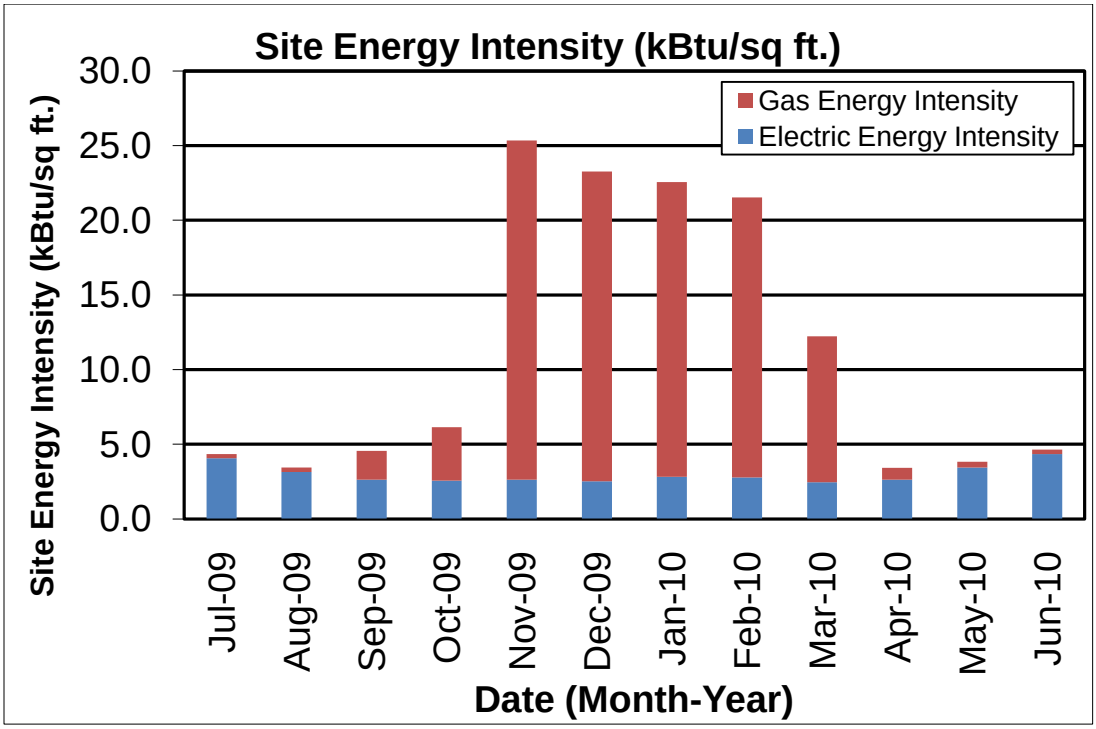




Energy benchmarking

SWA has entered energy information about the Fire Department in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. This fire station facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Fire Department is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 137.0kBtu/sq ft yr compared to the national average of a fire station consuming 78.0kBtu/sq ft yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for Fire Station space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the City of Summit desire to reach this average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.



Per the LGEA program requirements, SWA has assisted the City of Summit to create an ENERGY STAR® Portfolio Manager account and share the Fire Department facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager Account information with the City of Summit (user name of “cityofsummit” with a password of “cityofsummit”) and TRC Energy Services (user name of “TRC-LGEA”).

Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

Tariff analysis is performed to determine if the rate that a building is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by the boiler units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Typically, electricity prices also increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

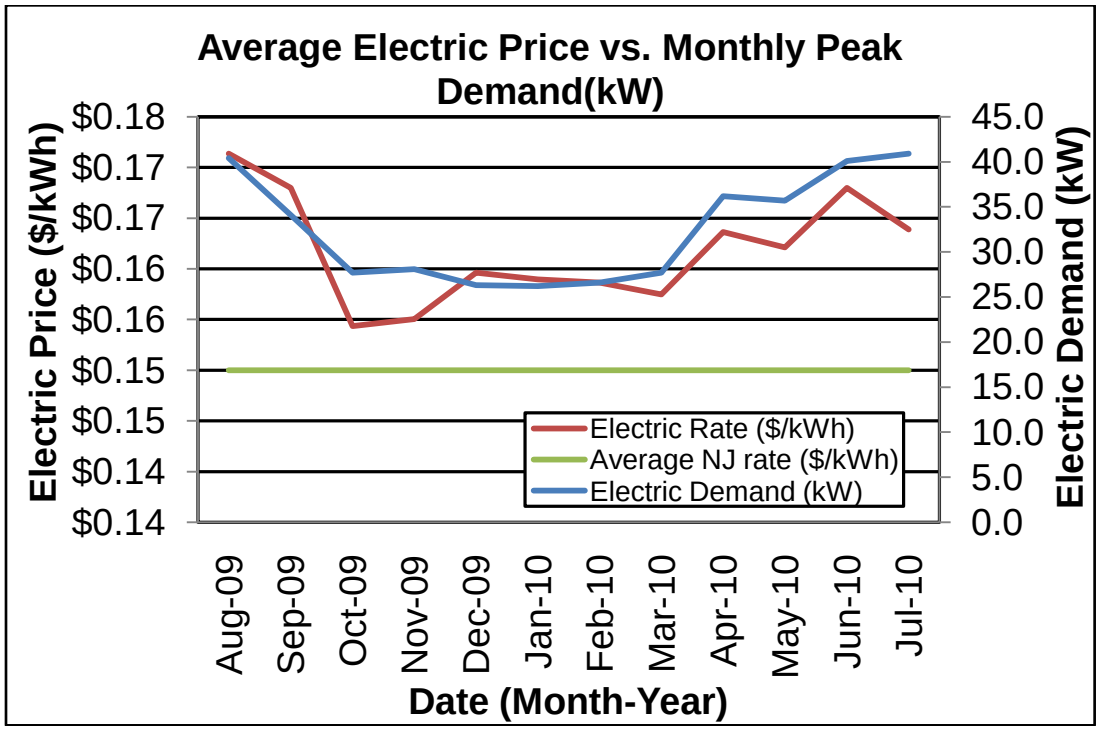
The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the

building is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

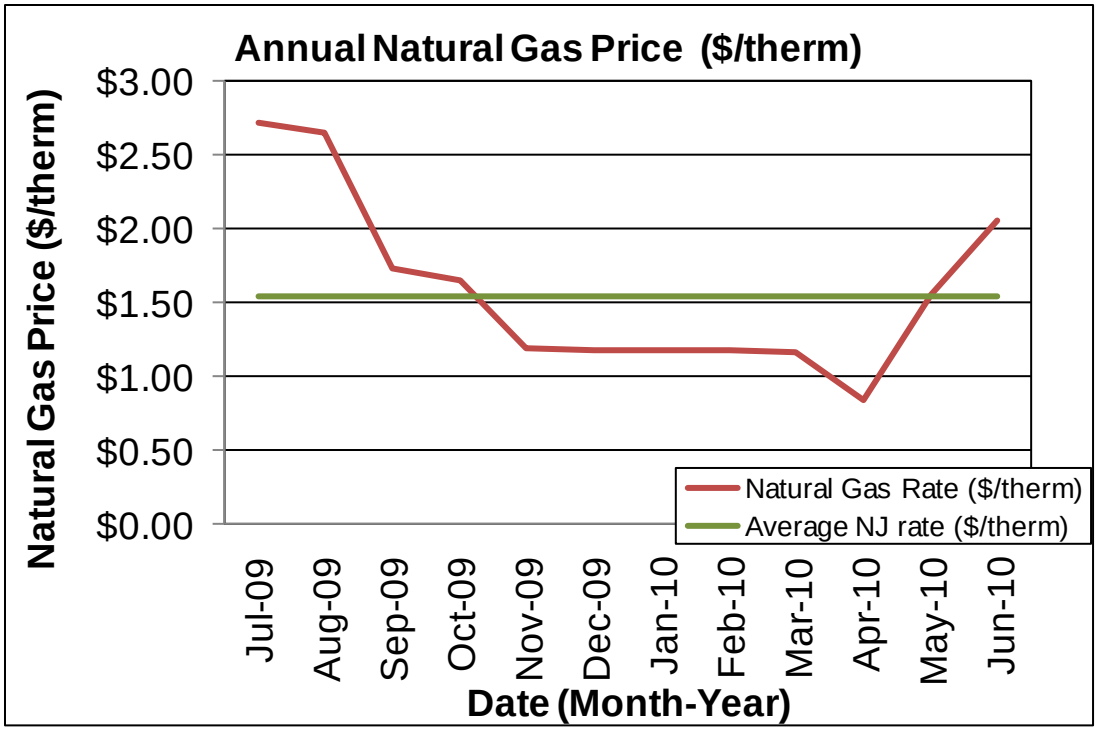
Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage per utility per 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 Fire Department pays a rate of $0.163/kWh. The Fire Department annual electric utility costs are $2,249 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 10% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Fire Department pays a competitive rate of $1.219/therm. Natural gas bill analysis shows fluctuations up to 69% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

SWA recommends that the Fire Department further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Fire Department. Appendix C contains a complete list of third-party energy suppliers for the City of Summit 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 the visit from SWA on July 29 and August 5, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story with a partial basement, 16,443 square foot Summit Fire Department building was originally built in 1948 upon the foundation and incorporating a portion of a 1901 Firehouse. The building was added to/renovated in 1968 and 1995. The Fire Department building houses firefighting equipment and apparatus, the fire company office spaces, a communication room, meeting rooms, storage spaces, two dorms (4 bed officer dorm and 10 bed firefighter dorm), a weight room, locker rooms, bathrooms, a ready room and a kitchen. The building also contains eight front facing engine bays - one engine deep except for one drive-through bay - two engine deep. It is an emergency operational center (however not a shelter). The basement was used in the past as a bomber shelter.

Main Entrance, North Façade

South-East Facing Façade

South Facing Façade, Rear Entrance

West Facing Façade

Building Occupancy Profiles

There are approximately eight occupants in the building at any onetime, 24 hours, seven days a week. Fire Department has 37 employees and 10 volunteers working in four platoons a 10/14 shift - two 10 hour days followed by two 14 hour nights. A platoon is made up of two officers, five firefighters and a dispatcher.

Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

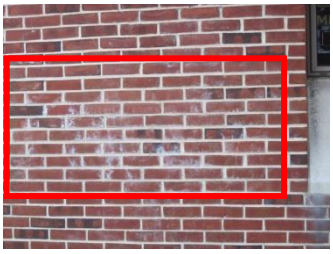
Exterior Walls

The older section of the exterior wall envelope consists of solid brick walls. Certain sections of the building are concrete block with brick veneer. The interior is painted CMU (Concrete Masonry Unit) or gypsum board.

No wall insulation could be detected in the field and construction drawings were not available for the building. According to building staff there is no wall insulation in the building.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in age-appropriate condition with signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

The following specific exterior wall problem spots and areas were identified:



Efflorescence on brick and masonry walls indicate moisture presence within the wall cavity

Efflorescence on brick and masonry walls indicate moisture presence within the wall cavity

Efflorescence on brick façade below window due to missing flashing

Roof

The building's 1995 roof is predominantly a flat, build-up roof with some parapet sections over steel decking, with a few sections of dark-colored EPDM finish. Roof insulation levels could not be verified in the field and no building drawings were available. SWA auditors were informed there are two inches of rigid insulation between roof decking and the roof top finish.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good, age-appropriate condition, with some signs of uncontrolled moisture, air-leakage and other energy-compromising issues mostly detected on flat roof areas.

Standing water due to insufficient roof pitch

Pitched asphalt roof

Cleared roof drains

Base

The building has a partial basement with poured concrete walls. The rest of the building is slab-on-grade with a perimeter footing with poured concrete foundation walls and no detectable slab edge/perimeter insulation.

Note: Slab/perimeter insulation levels could not be verified in the field and no construction plans were available.

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 only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Attempt to sound-proof Boiler room from Communications room above

Windows

The building contains one type of window.

The windows throughout the building are double-hung type windows with an aluminum clad frame, double glazing and interior mini blinds. The windows were installed during the 1968 renovation.

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. Some windows throughout the building have broken seals but overall, the windows

were found to be in acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific window problem spots were identified:

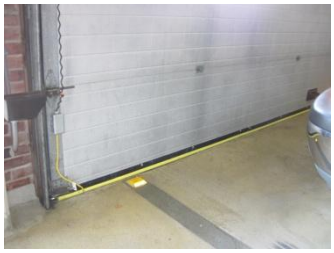
Broken sealants in windows and aged caulk around window perimeter

Exterior doors

The building contains several different types of exterior doors.

- Two glass with aluminum/steel frame type exterior doors. They are located at the entrance to the building.
- There are 10 overhead type insulated garage doors. According to building personnel, overhead doors were replaced approximately 20 years ago.
- There are two aluminum type exterior doors located in the rear and side of the building.

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 acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.



Garage doors with
sufficient weather-stripping

Building air-tightness

Overall, the field auditors found the building to be reasonably air-tight considering the building uses 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

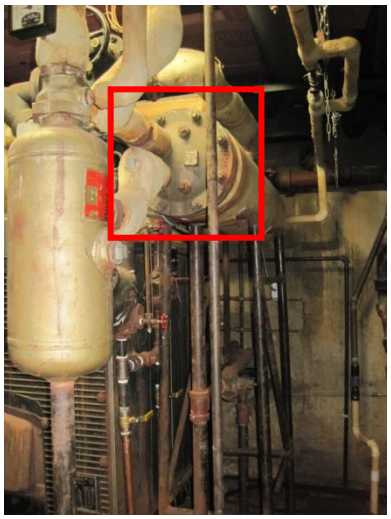
Heating Ventilation Air Conditioning

The Fire Department is heated via radiators, baseboard and hydronic terminal units with steam (for the 1948 building section) and hot water (for the 1968 building section) provided by a cast iron sectional boiler, heat exchanger and hot water pumps located in the basement. Various sections of the building are cooled by six rooftop units (RTUs) and associated distributive ducts. Three of the rooftop units are ductless mini split units. A comprehensive Equipment List can be found in Appendix A.

Equipment

An HB Smith 1,900MBtu/hr cast iron sectional boiler, installed in 1975, provides steam and hot water (via a nearby 5.68 sq ft of surface steam-hot water heat exchanger) to several steam radiators and ceiling hung ventilators in the 1948 section of the building, and perimeter baseboard heaters and ceiling hung hydronic ventilators in the 1968 section of the building. The boiler was converted from oil to gas firing in the early 1980s. It has a Power-Flame gas fired burner. The boiler's efficiency is estimated to be 80%. It has had repeated breakdowns in the last few years and is operating beyond its expected service life.
The building Maintenance would prefer heating via furnaces or RTUs, from similar systems that now provide the building with cooling only.

The 5.68 sq ft of surface steam-hot water heat exchanger and un-insulated hot piping (center)
The HB Smith cast iron sectional boiler (below)



Condensate return pump (below)

The 1980 and 1968 original steam-hot water heat exchanger, radiators, baseboard and hydronic terminal units located throughout the building are operating beyond their expected

service lives. After so many years in operation the heat transfer surface areas are fouled which is considerably reducing their efficiency to heat spaces. The heating hot water circulation pumps are also operating beyond their expected service lives and should be upgraded or replaced with a different system. The B&G 8 gpm capacity condensate return pump and system was replaced two years ago and appears in good operating condition. However, the bulk of the heating generating system and its distributed terminal units is in poor condition and should be replaced with the next major renovation.

Hot water 1968 Engine Bay ventilator (below)

Steam radiator & manual adjustment

Steam 1948 Engine Bay ventilator

The Fire Department is cooled by six rooftop package units (RTU).

The 2 ton mini spilt ductless RTU, 10 SEER, serving the Administration office and Chief's office is operating beyond its expected service life.

The 2 ton RTU, 10 SEER, serving the Conference room is operating within the last two years of its expected service life. It has an unutilized (not hooked up to natural gas) 40,000 Btu/hr furnace capacity.

The 7-1/2 ton RTU, 10.1 EER, serving the Officer and Firefighter dormitories is operating within the last two years of its expected service life.

The 1 ton mini spilt ductless RTU, 10 SEER, serving the 2nd floor Conference room is operating within the last two years of its expected service life.

The 1 ton mini spilt ductless RTU, 10 SEER, serving the Dispatch room is operating within the last two years of its expected service life.

The 2 ton mini spilt ductless heat pump RTU, 16 SEER, serving the Ready room and Kitchen has a 95% remaining expected service life. It has a 26,000 Btu/hr heating capacity.

Generally, all RTUs and matching air handlers/evaporators are performing satisfactorily however the majority are quickly approaching the end of their expected service lives.

The ductless mini split air conditioners are a cost effective alternative to central air conditioning. While slightly more expensive than the typically wall or window air conditioner, the minor additional cost is easily and quickly recouped in energy savings. Since the compressor sits on the outside, the ductless mini split air conditioner is very quiet and efficient. Also, since ductless mini split air conditioners have no ducts; they avoid the

energy losses associated with the ductwork of central forced air systems. Duct losses can account for more than 30% of energy consumption for space conditioning, especially if the ducts are in unconditioned spaces such as an attic. Like central air conditioning units, ductless mini split air conditioners have two main components: an outdoor unit or compressor/condenser, and an indoor unit or evaporator/air-handling unit. The two units are connected by the power cables, refrigerant tubing, suction tubing, and a condensate drain. These connecting pipes link the outdoor and indoor units through a small hole that is drilled in the wall of the building. The advantages of ductless mini split air conditioner are their small size and flexibility for zoning, heating, or cooling to individual rooms. Since each of the ductless mini split air conditioner zones or rooms will have an individual thermostat, only that area where someone is present needs to be conditioned, saving additional energy and money.

Each of the two larger rooftop units contains a direct expansion (DX) system for cooling, made up of an evaporator, condenser and refrigerant loop. R-22 refrigerant absorbs heat from the passing air in the evaporator coil and transfers the heat to the atmosphere in the condenser.

- Officer & Firefighter Dorm RTU (top left)
- Ready room, Kitchen & Dispatch mini splits (above)
- Conference Room RTU (top right)

Dispatch air handler/evaporator

Kitchen air handler/evaporator

The Officer and Firefighter dormitories and the Conference room are provided ventilation by outside air intake louvers on the rooftop units. The outside air louvers are manually fixed to allow economizer efficient operation when the outside air conditions are favorable. Kitchen and bathroom exhaust fans also help ventilate the building. The exhaust from the fire trucks is captured via rapid disengaging hoses and ducted to two outside wall mounted exhaust fans operated only when the trucks are warmed up to leave. Three wall fans ventilate the hose tower and Engine Bays. The balance and majority of fresh air brought into the building appears to be via door openings and infiltration. All building exhaust fans are in passable condition however operating beyond their expected service lives.

Wall mounted truck exhaust fan (left)

Hose Tower exhaust fan (center)

Kitchen exhaust fan (right)

Distribution Systems

A typical rooftop unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through the furnace (not active in the Firehouse) section before the conditioned air is distributed into the building spaces. The DX system is only active in the cooling season. In between seasons only the blower will be active to provide fresh air to the building.

The Fire Department Officer and Firefighter dormitories and the Conference room RTUs distribute conditioned air to associated spaces via a ductwork system and diffusers. The ducts are insulated on the inside for heat and noise abatement. The RTUs are activated on/off via thermostats that satisfy the temperature settings of the rooms that they serve.

Heating hot water and steam are distributed throughout the building to terminal units. Condensate and return hot water are circulated back to the boiler.

Controls

The cooling equipment is controlled by programmable thermostats. All heating is controlled by manual thermostats and manual valves.

Manual control valves on radiators and programmable thermostats for cooling (typical)

Domestic Hot Water

The domestic hot water (DHW) for the Fire Department is provided by a natural gas heated Lochinvar, LTN050G with 50 gal storage. It has an estimated Energy Factor efficiency of 0.62. This DHW heater appears in satisfactory condition and has a 45% remaining estimated service life.

Gas fired 50 gal DHW heater serving the Fire Department building (left)

Electrical systems

Lighting

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

As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps will no longer be produced for commercial and industrial applications. Also, many T12 lamps will be phased out of production starting July 2012.

Interior Lighting - The Fire Department currently contains T12, T8 fixtures and ceiling mounted incandescent and CFL fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide lamp and incandescent fixtures. Exterior lighting is controlled by photocells.

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, printers, etc… 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.

Elevators

The Fire Department does not have an installed elevator.

Pneumatic Air

Pneumatic air from an Emglo pneumatic air system, in conjunction with a Kaeser refrigerated dryer is used to maintain the truck brakes. The equipment appears in satisfactory condition and has a 25% remaining estimated service life.

Fuel Station

A 4,000 gallon gasoline and a 6,000 gallon diesel double containment underground fuel tanks and associated above ground fueling stations are used to service the Fire Department truck fuel needs. The equipment is continuously monitored for leaks. The equipment appears in satisfactory condition and has a 50% remaining estimated service life.

Other electrical systems

There are not currently any significant energy-impacting electrical systems installed at the Fire Department, except for an Onan GenSet 50 kW/62.5 kVA emergency generator backup operated on diesel. The generator appears in satisfactory condition and has a 45% remaining estimated service life. Also, the incoming power main transformer is owned/maintained by JCP&L and it appears in satisfactory condition.

Onan GenSet emergency 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 state and federal 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. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

Existing systems

Currently, there is not a renewable system installed at the Summit Fire Department.

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 Fire Department is a good candidate for a 30 kW Solar Panel installation. See ECM#8 for details.

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

The Fire Department is not a good candidate for a wind power generation due to unfavorable wind conditions in this area of New Jersey.

Geothermal

The Fire Department is not a good candidate for a geothermal installation since there is insufficient surrounding area for installation and insufficient incentives to make this investment pay back in less than 20 years.

Combined Heat and Power

The Fire Department is not a good candidate for a 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 high electrical base-load to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

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

ECM#	Description of Recommended 0-5 Year Payback ECMs
1	Upgrade (6) Thermostats to Programmable Type
2	Install (23) New CFL Fixtures
3	Install (1) New T5 Fixture
4	Replace (6) Old Engine Bay Hydronic and Steam Ceiling Hung Heaters with (6) 60,000 Btu/hr Infrared Heaters
5	Install (4) New T8 Fixtures
6	Install (36) Lighting Occupancy Sensors
ECM#	**Description of Recommended 5-10 Year Payback ECMs**
7	Replace Old Refrigerator with an ENERGY STAR® Model
8	Install a 30 kW Solar Photovoltaic Rooftop System
ECM#	**Description of Recommended >10 Year Payback (End of Life Cycle)**
9	Install (12) New Pulse Start Metal Halide Fixtures
10	Replace Old Boiler and HVAC System with (2) Condensing Furnaces and High Efficiency AC Condensers

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: Upgrade (6) Thermostats to Programmable Type

During the field audit, SWA completed a building HVAC controls analysis and observed spaces in the building where temperature is manually controlled without setbacks to reduce energy consumption during unoccupied periods of time, such as evenings and weekends. Programmable thermostats offer an easy way to save energy when correctly used. By turning the thermostat setback 10-15 degrees F for eight hours at a stretch (at night), the heating bill can be reduced substantially (by a minimum of 10% per year). In the summer, the cooling bill can be reduced by keeping the conditioned space warmer when unoccupied, and cooling it down only when using the space. The savings from using a programmable thermostat is greater in milder climates than in more extreme climates. Temperature settings and time periods should be checked and optimized for spaces that have already been retrofitted with programmable thermostats. 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:

Estimated installed cost: $1,002 (includes $551 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

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
1,002	0	1,002	2,572	0.0	1,571	10.1	1,458	3,793	12	45,513	0.3	4442	370	379	35,178	21,918

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 50 min/wk to make manual adjustments vs. installed programmable thermostats. SWA assumed that temperatures would be setback based on the operation schedule of the building and used ENERGY STAR® site: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TH , Excel spreadsheet for Savings Calculator as well as assumed a conservative 10% savings of heating/cooling loads when systems are operating per pre-agreed settings. Existing air conditioning thermostats will need re-programming for actual schedules and realistic setbacks.

Rebates/financial incentives:

- There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#2: Install (23) New CFL Fixtures

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting also contains inefficient incandescent lamps. SWA recommends that each incandescent lamp is replaced with a more efficient, Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. 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:

Estimated installed cost: $868 (Includes $173 of labor)
Source of cost estimate: Manufacturers information

Economics:

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
868	0	868	4,411	0.9	0	1.5	1,091	1,752	5	8,762	0.5	909	182	201	6,891	7,898

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 27 hrs/yr to replace aging burnt out lamps/fixtures vs. newly installed.

Rebates/financial incentives:

- There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#3: Install (1) New T5 Fixture

On the day of the site visit, SWA completed a lighting inventory of the building (see Appendix B). The existing lighting inventory contained one High Pressure Sodium fixture. SWA recommends replacing each existing fixture with more efficient, T5 fluorescent fixtures with electronic ballasts. T5 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 20% when compared to a High Pressure Sodium fixture.

Installation cost:

Estimated installed cost: $194 (includes $63 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

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
210	16	194	543	0.1	0	0.2	150	231	15	3,472	0.8	1690	113	119	2,451	972

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 4 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Smart Start - T5 fixtures with electronic ballasts ($16 per fixture). Maximum incentive amount is $16.

Please see Appendix F for more information on Incentive Programs.

ECM#4: Replace (6) Old Engine Bay Hydronic and Steam Ceiling Hung Heaters with (6) 60,000 Btu/hr Infrared Heaters

During the field audit, SWA inspected old hydronic and steam ceiling hung heaters in Engine Bays which are operating beyond their estimated service lives. SWA recommends the replacement of these existing old and inefficient heaters.

SWA recommends replacement with ceiling mounted infrared gas fired heaters. Gas fired infrared heaters are sometimes called mini suns because they rely on gas consumption to generate heat. Infrared heat warms people and objects at occupancy level, not the air in the room. This is a major advantage because warmed air rises to the ceiling where it is not needed, and wastes the fuel dollars spent to heat it. Most infrared heaters employ gas combustion to heat a steel tube (tube heater) or ceramic surface (luminous (high intensity) heater), which subsequently emits infrared heat. It's important to note how much infrared heat is emitted. An infrared heater produces both infrared radiant heat (that is directed at people and objects) and convection heat that rises and is for the most part lost. Even so, these infrared heaters generally have efficiencies greater than 90%.

Installation cost:

Estimated installed cost: $5,400 (includes $2,835 of labor; not included are such activities as design, engineering, any civil and structural work, permitting and general conditions)
Source of cost estimate: Similar projects

Economics (with incentives):

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
7,200	1,800	5,400	741	0.0	1,179	7.3	105	1,663	20	33,268	3.2	516	26	31	18,310	14,322

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing units require additional annual repairs vs. a new heater.

Rebates/financial incentives:

- NJ Clean Energy - Gas Furnace ($300 per furnace, >92% AFUE) - Maximum incentive amount is $1,800.

Please see Appendix F for more information on Incentive Programs.

ECM#5: Install (4) New T8 Fixtures

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting contains inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. 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:

Estimated installed cost: $589 (Includes $194 of labor)
Source of cost estimate: Manufacturers information

Economics:

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
649	60	589	601	0.1	0	0.2	67	158	15	2,363	3.7	301	20	26	1,225	1,076

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 2 hrs/yr to replace aging burnt out lamps/ballasts vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Retrofit T12 with T8 fixtures with electronic ballasts ($15 per fixture) - Maximum incentive amount is $60.

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install (36) Lighting Occupancy Sensors

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via occupancy sensors. SWA identified a number of areas that could benefit from the installation of occupancy sensors. SWA recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a means to control lighting operation. 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:

Estimated installed cost: $7,200 (Includes $2,376 of labor)
Source of cost estimate: Manufacturers information

Economics:

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
7,920	720	7,200	10,142	2.1	0	3.5	0	1,521	15	22,819	4.7	217	14	20	10,369	18,159

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

Rebates/financial incentives:

- NJ Clean Energy - Occupancy sensors, wall mounted ($20 per control) - Maximum incentive amount is $720.

Please see Appendix F for more information on Incentive Programs.

ECM#7: Replace Old Refrigerator with an ENERGY STAR® Model

On the days of the site visit, SWA observed older refrigerators that are not ENERGY STAR® rated (using as much as 769 kWh/yr). SWA highly recommends the Township of Summit consider replacement of all refrigerators over 10-12 years of age with more modern, ENERGY STAR®, energy efficient appliances. SWA also recommends the removal of any unused smaller refrigerators as seen in the kitchenette. In addition to saving energy, the replacements will also keep the refrigerator locations cooler. Furthermore, the older model refrigerators may utilize R-12 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-134A or R-404A refrigerant. When compared to the average electrical consumption of older equipment, ENERGY STAR® equipment results in large savings. Look for the ENERGY STAR® label when replacing appliances and equipment, including window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $750 (Includes $50 of labor)
Source of cost estimate: Energy Star purchasing and procurement site, similar projects, manufacturer and store established costs

Economics:

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
750	0	750	454	0.0	0	0.1	50	124	12	1,488	6.1	98	8	13	455	813

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumed one annual call to a refrigeration contractor to perform minor repairs on old refrigerators.

Rebates/incentives:

- There are no incentives at this time offered by NJ Clean Energy for this energy conservation measure.

Please see Appendix F for more information on Incentive Programs.

ECM#8: Install a 30 kW Solar Photovoltaic Rooftop System

Currently, the building 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 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 PV system could be installed on a portion of the roof with panels facing south. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 30 kW system needs approximately 130 panels which would take up 2,280 square feet.

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. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. Please see below for more information.

Please note that this analysis did not consider the structural capability of the existing building to support the above recommended system. SWA recommends that the City of Summit contract with a structural engineer to determine if additional building structure is required to support the recommended system and what costs would be associated with incorporating the additional supports prior to system installation. Should additional costs be identified, the City of Summit should include these costs in the financial analysis of the project.

Installation cost:

Estimated installed cost: $187,500 (includes $120,000 of labor)
Source of cost estimate: Similar projects

Economics (with incentives):

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
210,000	22,500	187,500	35,400	30.0	0	7.3	0	26,767	25	669,182	7.0	257	10	12	$152,939	63,384

Cash flow:

Annual Solar PV Cost Savings Breakdown

Rated Capacity (kW)	30.0
Rated Capacity (kWh)	35,400
Annual Capacity Loss	0%

Year	kWh Capacity	Installed Cost	Incentives	Electric Savings ($)
0		$210,000	$22,500	
1	35,400		$21,000	$5,767
2	35,400		$21,000	$5,767
3	35,400		$21,000	$5,767
4	35,400		$21,000	$5,767
5	35,400		$21,000	$5,767
6	35,400		$21,000	$5,767
7	35,400		$21,000	$5,767
8	35,400		$21,000	$5,767
9	35,400		$21,000	$5,767
10	35,400		$21,000	$5,767
11	35,400		$21,000	$5,767
12	35,400		$21,000	$5,767
13	35,400		$21,000	$5,767
14	35,400		$21,000	$5,767
15	35,400		$21,000	$5,767
16	35,400		$0	$5,767
17	35,400		$0	$5,767
18	35,400		$0	$5,767
19	35,400		$0	$5,767
20	35,400		$0	$5,767
21	35,400		$0	$5,767
22	35,400		$0	$5,767
23	35,400		$0	$5,767
24	35,400		$0	$5,767
25	35,400		$0	$5,767
	kWh	Cost	Saving	
Lifetime Total	**885,000**	**($210,000)**	**$337,500**	**$144,182**

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.75 / watt Solar PV application for systems 30 kW or less. Incentive amount for this application is $22,500 for the proposed option. http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

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 annual SREC credit of $21,000 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

Please see Appendix F for more information on Incentive Programs.

ECM#9: Install (12) New Pulse Start Metal Halide Fixtures

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing lighting contains standard probe start Metal Halide (MH) lamps. SWA recommends replacing the higher wattage MH fixtures with pulse start MH lamps which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They 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:

Estimated installed cost: $5,063 (Includes $1,608 of labor)
Source of cost estimate: Manufacturers information

Economics:

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
5,363	300	5,063	2,996	0.6	0	1.0	48	497	15	7,453	10.2	47	3	5	760	5,364

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 1.2 hrs/yr to replace aging burnt out lamps/ballasts vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Pulse Start Metal Halide ($25 per fixture) - Maximum incentive amount is $300.

Please see Appendix F for more information on Incentive Programs.

ECM#10: Replace Old Boiler and HVAC System with (2) Condensing Furnaces and High Efficiency AC Condensers

During the field audit, SWA inspected the old basement steam boiler, associated water-steam exchanger, hydronic and steam terminal units. They are all operating beyond their estimated service lives. The majority of the rooftop air conditioning units are within a couple of years from the end of their estimated service lives. SWA recommends replacement of the existing old HVAC system with two ENERGY STAR® high efficiency condensing furnaces and two associated high efficiency rooftop condensers.

The coils of boiler and associated steam/water system may be partly fouled. The pump motors are standard rather than NEMA premium efficiency. SWA recommends replacement with two ENERGY STAR® condensing furnaces of 93% Annual Fuel Utilization Efficiency (AFUE) rating. Both furnaces will be placed in two corner closets of the building, one serving the 1st floor, the other serving the 2nd floor. The heat capacity of each furnace should match the capacity required to heat each floor (except for the Engine Bays - to be heated by efficient Infrared gas heaters). Evaporator coils should be installed in the furnace discharge ducts for cooling the re-circulating air with environmentally friendly refrigerant such as R-410A via a matching split rooftop condenser which should replace several lower efficiency existing units.

SWA recommends that the replacement furnaces be two-stage furnaces, which is like having two furnaces in one. On the coldest days, the furnace operates in the high-stage mode at 100% capacity. But on most days, the furnace comfortably conserves energy by operating in the low-stage mode at just 70% capacity. The two-stage gas valve runs quietly on the low stage 90% of the time, producing just 25% of the normal high-fire sound, while significantly reducing energy consumption. A central furnace control orchestrates the various functions of the furnace with digital accuracy. Functions like the blower and inducer motor are monitored for proper operation, increasing safety and reliability. SWA also recommends features like the corrosion-resistant, aluminized steel tubular heat exchanger with stainless-steel recuperative coil which will provide many years of trouble-free service. Plus, a furnace heavy-gauge, reinforced and insulated steel cabinet. The high-efficiency combustion process allows venting with 2 - 4 inch PVC without the need for a traditional chimney flue. And because it can be direct-vented to the outside, fresh air can be used for combustion. The fuel stingy auto-ignition system eliminates the old-fashioned standing pilot for greater ignition dependability without the wasted energy.

Essentially, SWA is recommending one central furnace and air conditioner for each floor. In a split-system central air conditioner, an outdoor (rooftop) metal cabinet contains the condenser and compressor, and an indoor cabinet (in the furnace discharge duct) contains the evaporator. Central air conditioners are more efficient than room air conditioners. In addition, they are out of the way, quiet, and convenient to operate. For an older central air conditioner, consider replacing the outdoor compressor with a modern, high-efficiency unit. Today's best air conditioners use 30%–50% less energy to produce the same amount of cooling as air conditioners made twenty years ago. Even if the air conditioner is only 10 years old, savings may be 20%–40% of the cooling energy costs by replacing it with a newer, more efficient model. Proper sizing and installation are key elements in determining air conditioner efficiency. Too large a unit will not adequately remove humidity. Too small a unit will not be able to attain a comfortable temperature on the hottest days. Improper unit location, lack of insulation, and improper duct installation can greatly diminish efficiency.

When buying an air conditioner, look for a model with a high efficiency. Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER). SEER (Btu/Watt-hr) indicates the relative amount of energy needed to provide a specific cooling output. Many older systems have

SEER ratings of 6 or less (excluding the years of equipment degradation). The minimum SEER allowed today is 13. Look for the ENERGY STAR® label for central air conditioners with SEER ratings of 13 or greater, but consider using air conditioning equipment with higher SEER ratings for greater savings. SEER 13 is 30% more efficient than the previous minimum SEER of 10. The "lifespan" of a central air conditioner is about 15 to 20 years. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov .

The proposed replacement is a follows:

- Install one condensing furnace sized for 70,000 Btu/hr heating with a 5 ton rooftop condenser 15 SEER to heat/cool the 1st floor administration area and replace three old rooftop air conditioning units. Install additional ductwork and three variable air volume (VAV) boxes for efficient air distribution and control.

- Install one condensing furnace sized for 120,000 Btu/hr heating with a 8.5 ton rooftop condenser 13 EER to heat/cool the 2nd floor area and replace two old and one new (to be kept on standby) rooftop air conditioning units. Install additional ductwork and three VAVs for efficient air distribution and control.

This upgrade will save approximately $90,000 vs. replacing the existing boiler and HVAC system in kind.

Installation cost:

Estimated installed cost: $72,000 (includes $38,586 of labor; not included are such activities as design, engineering, any civil and structural work, permitting and general conditions)
Source of cost estimate: Manufacturer and Store established costs, NJ Clean Energy Program, Similar Projects

Economics (with incentives):

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
Replace Existing HVAC: (1) Boiler, (1) Steam-Hot Water Exchanger, Hydronic and Steam Terminal Units & (6) AC Units in Kind (Boiler & Heat Exchanger (a), 1st floor (b) and 2nd floor (c) rooftop AC units)																
a-110,000	0	110,000	0	0.0	0	0.0	900	900	25	22,500	122.2	-80	-3	-10	-91,736	0
b-21,375	0	21,375	0	0.0	0	0.0	900	900	15	13,500	23.8	-37	-2	-5	-10,450	0
c-30,375	0	30,375	0	0.0	0	0.0	900	900	15	13,500	33.8	-56	-4	-9	-19,171	0
Replace (1) 80% Efficient Boiler and Associated Heating and Cooling with (2) 95% Efficient Condensing Furnace and High Efficiency Condensers (1st floor (d) and 2nd floor (e))																
d-20,000	860	19,140	2,014	0.0	287	2.2	0	678	15	10,164	28.2	-47	-3	-7	-10,821	6,765
e-52,000	984	51,016	1,437	0.0	487	3.3	0	828	15	12,422	61.6	-76	-5	-14	-39,992	7,942
Replace Old Boiler and HVAC System with (2) Condensing Furnaces and High Efficiency AC Condensers																
72,000	**1,844**	**70,156**	**3,451**	**0.1**	**774**	**5.4**	**2,700**	**4,206**	**15**	**63,085**	**16.7**	**-10**	**-1**	**-1**	**-20,026**	**14,707**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. In order to estimate savings for this measure, SWA

assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing units require additional annual repairs vs. new furnaces and condensers.

Rebates/financial incentives:

- NJ Clean Energy - SmartStart - Gas Furnace ($400 per furnace, >92% AFUE, with electronic commutated motor or equivalent) - Maximum incentive amount is $800.

- NJ Clean Energy - SmartStart - Unitary HVAC / Split System, <5.4 tons ($92 per ton, 14 SEER) and >5.4 to <11.25 tons ($73 per ton, 11.5 EER) - Maximum incentive amount is $1,044

Please see Appendix F 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. 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, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Fire Department:

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- During the next major construction, SWA recommends insulating the exterior walls of the structure by adhering 2" polyiso boards (Polyisocyanurate, see http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11590) together with furring strips to the inside of the CMU or brick walls.

- Replace building exhaust fans - this equipment is operating beyond its expected service life and driven by fractional horsepower motors, so the replacements cannot be justified by energy savings alone and there are no NJ Clean Energy rebates available. However, due to the age of the equipment, replacement is recommended.

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.

- Insulate hot water piping in the Boiler room and throughout the building, in order to deliver hot water where it is needed, without delay and energy losses, while providing personnel protection at the same time. This measure would depend on the heating system replacement.

- Thoroughly and evenly insulate space above the 2nd floor ceiling tiles and plug all ceiling penetration. Any missing ceiling tiles should be put back in place.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly and drains are cleaned.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage. SWA recommends round downspout elbows to minimize clogging.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Any exterior door should be weather-stripped, including the Dispatch room door that leads to an unconditioned corridor. The perimeter of all window frames should also be regularly inspected, and any missing or

deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - SWA recommends as part of the maintenance program installing proper flashing and correct masonry efflorescence, and sealing wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

- 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. Aerators in the some bathrooms were rated 2.0gpm. Building staff can also easily install 0.5gpm faucet aerators and/or low-flow fixtures to reduce water consumption. Showerheads should also be replaced with low flow options. 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.

- 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/.

- Change filters on rooftop package units monthly to ensure efficient operation of the blowers and ensure adequate air delivery to the spaces.

- Tighten belts on exhaust fans and blowers every three to six months - Tightening belts on belt-driven fans/blowers can maximize the overall efficiency of the equipment.

- Inspect rooftop package units' coils for dirt buildup three to six months. These conditions should be rectified if found because they will cause inefficient operation and possibly damage to the equipment.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Summit. Based on the requirements of the LGEA program, Summit must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $1,567 (or 25% of $6,266).

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Rooftop AC, R-22 refrigerant, 2 tons of refrigeration, est 10 SEER	Carrier Condenser 38ED024310, Serial # erased, AHU 40D0024300XJ, Serial # Y416450	Electric	Rooftop	Admin Office and Chief's Office	1985	0%
Cooling	Rooftop AC (with 40,000 Btu/input furnace capacity not used), 2 tons of refrigeration, est 10 SEER	Carrier RTU 48SS-024040321AA, Serial # G597G11329	Electric	Rooftop	Conference Room	1997	15%
Cooling	Rooftop AC, 7-1/2 tons of refrigeration, no heating feature, est 10.1 EER	Carrier RTU 50GJ-008-501, Serial # 1796G30321 ConFab, CRPWREX-002A00, Serial # 25168 - 1HP motor	Electric	Rooftop	Officer and Firefighter Dorms	1997	15%
Cooling	Rooftop AC, 12,000 Btu/hr cooling, est 10 SEER	Sanyo split unit condenser CL1211, Serial # 0042464; evaporator KS1211W, Serial # 0270764;	Electric	Rooftop condenser; 2nd Flr Conf Rm evaporator	Rooftop condenser; 2nd Flr Conf Rm evaporator	1997	15%
Cooling	Rooftop AC, 12,000 Btu/hr cooling, R-22 refrigerant, est 10 SEER	Sanyo split unit condenser CL4232A, Serial # 0001942; evaporator TS4232, Serial # 0005943;	Electric	Rooftop condenser; Dispatch Rm evaporator	Rooftop condenser; Dispatch Rm evaporator	1997	15%

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Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Rooftop AC, 26,000 Btu/hr cooling, 27,000 Btu/hr heating capacity, Mr. Slim, R410A refrigerant, est 16 SEER for this dual zone ductless mini split heat pump	Mitsubishi split unit condenser MXZ-3A30NA, Serial 92906943D; evaporator MSZ-A17NA, Serial 9000509T - Ready Rm; MSZ-A12NA, Serial # 8010494 - kitchen;	Electric	Rooftop Condenser, Ready Rm and Kitchen evaporators	Rooftop Condenser, Ready Rm and Kitchen evaporators	2010	95%
Heating	Steam boiler - cast iron sectional, 1,900 MBH max capacity; est 80% efficiency	HB Smith Serial # CHB0408; Power-Flame burner CZ-GO-15-HBS-Y, Serial # 107719164, max 1,600 MBH	Natural Gas	Basement Boiler Rm	Firehouse	1975	0%
Heating	Steam-hot water heat exchanger, 5.68 sq ft surface	Missing Manufacturer Name, #SC845.4	N/A	Basement Boiler Rm	Firehouse - 1968 section	1968	0%
Heating	Condensate return pump and system, 8 gpm capacity	B&G Hoffman Watchman WO-6-20-P, Serial # 160029; Marathon 1/3 HP pump motor	Electric	Basement Boiler Room	Boiler and Bldg	2008	90%
Heating	3 steam ceiling hung units	Modine HS108501, Serial #05014 190	Electric (Fan)	1948 Engine Bays	1948 Engine Bays	1980	0%
Heating	3 hydronic ceiling hung units	Airtherm, illegible name tags	Electric (Fan)	1968 Engine Bays	1968 Engine Bays	1980	0%
Heating	2 Hot water circulators	Bell & Gossett M80027, 1/3 HP	Electric (Fan)	Basement Boiler Room	Boiler and Bldg	1968	0%

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Building System	**Description, % eff**	**Model # / Serial #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
DHW	50 gal storage, 40,000 Btu/hr capacity with circulation pump, est Energy Factor is 0.62 (per http://www.energystar.gov/index.cfm?fuseaction=gas_storage.display_products_html)	Lochinvar LTN050G, Serial # BA5742692; ¾ HP IC motor on circulation pump	Natural Gas	Boiler Basement Rm	Firehouse	2004	45%
Ventilation	3 X 40" wall fans with louvers	Missing nametags	Electric	Engine Bays and Hose Twr	Engine Bays and Hose Twr	1980	0%
Ventilation	2 Engine Bay Exhaust systems	Dayton,1/3 HP	Electric	East and West Exterior Walls	Engine Bays	1968	0%
Pneumatic Air	Pneumatic air to maintain truck brakes	Emglo System, EQ3B-60 Serial # 030287005	Electric	Basement Boiler Rm	Trucks	1995	25%
Pneumatic Air Dryer	Pneumatic air dryer to maintain truck brakes, 15 scfm capacity	Kaeser KRD015 refrigerant air dryer, Serial # K015A115160 9909067	Electric	Basement Boiler Rm	Trucks	1995	25%
Under-ground storage tank	E-5 - 4,000 gal - gasoline with fuel pump - underground, inside containment, with Veeder Root TLS350 Leak Monitor System	Missing nametag	N/A	Under-ground	Site Fuel Station	1998	50%
Under-ground storage tank	E-6 - 6,000 gal - diesel with fuel pump - underground, inside containment, with Veeder Root TLS350 Leak Monitor System	Missing nametag	N/A	Under-ground	Site Fuel Station	1998	50%
Generator	50 kW/62.5 kVA emergency generator	Onan GenSet 50DGCA, Serial # 3A970628354	Electric/ Diesel	Back of Firehouse	Firehouse	1997	45%
Lighting	See details - Appendix B	See details - Appendix B	Electric	Firehouse	Firehouse	Varies	Avg - 20%

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: 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	Chiefs office	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	9	365	5	414	1,360	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	6	2	32	7	365	5	414	1020	0	340	340
2	1	Deputy Chiefs office	Recessed Parabolic	E	4'T8 U-Shaped	4	2	32	Sw	9	365	5	276	907	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	4	2	32	7	365	5	276	680	0	227	227
3	1	Office area \ hallway	Recessed Parabolic	E	4'T8 U-Shaped	16	2	32	Sw	24	365	5	1,104	9,671	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	16	2	32	18	365	5	1104	7253	0	2418	2418
4	1	Lieutenant office	Recessed Parabolic	E	4'T8 U-Shaped	5	2	32	Sw	9	365	5	345	1,133	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	5	2	32	7	365	5	345	850	0	283	283
5	1	Lieutenant office	Ceiling Mounted	M	4'T12	1	2	40	Sw	9	365	12	92	302	T8	Ceiling Mounted	4'T8	E	OS	1	2	32	7	365	5	69	170	76	57	132
6	1	Office	Recessed Parabolic	E	4'T8 U-Shaped	4	2	32	Sw	9	365	5	276	907	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	4	2	32	7	365	5	276	680	0	227	227
7	1	Conference rm	Recessed Parabolic	E	4'T8 U-Shaped	8	2	32	Sw	2	365	5	552	403	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	8	2	32	2	365	5	552	302	0	101	101
8	1	Bathroom Men	Recessed Parabolic	E	4'T8 U-Shaped	1	2	32	Sw	4	365	5	69	101	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	1	2	32	3	365	5	69	76	0	25	25
9	1	Bathroom Women	Recessed Parabolic	E	4'T8 U-Shaped	1	2	32	Sw	4	365	5	69	101	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	1	2	32	3	365	5	69	76	0	25	25
10	1	Radio room	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	OS	1	1	20	1	365	0	20	5	15	2	16
11	1	Garage	Wall Mounted	E	4'T8	1	2	32	Sw	12	365	5	69	302	C	Wall Mounted	4'T8	E	OS	1	2	32	9	365	5	69	227	0	76	76
12	1	Garage	Ceiling Mounted	E	4'T8	27	2	32	Sw	12	365	5	1,863	8,160	C	Ceiling Mounted	4'T8	E	OS	27	2	32	9	365	5	1863	6120	0	2040	2040
13	1	Garage	Wall Mounted	E	8'T8	1	2	59	Sw	12	365	7	125	548	C	Wall Mounted	8'T8	E	OS	1	2	59	9	365	7	125	411	0	137	137
14	Ext	Exterior	Ceiling Mounted	E	Inc	4	1	60	PC	12	365	0	240	1,051	CFL	Ceiling Mounted	CFL	E	PC	4	1	20	12	365	0	80	350	701	0	701
15	Ext	Exterior	Ceiling Mounted	S	MH	5	1	75	PC	12	365	21	480	2,102	PSMH	Ceiling Mounted	PSMH	S	PC	5	1	50	12	365	10	300	1314	788	0	788
16	1	Decontamination	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	365	5	138	101	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	365	5	138	101	0	0	0
17	1	Garage	Recessed Parabolic	E	4'T8 U-Shaped	11	2	32	Sw	12	365	5	759	3,324	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	11	2	32	12	365	5	759	3324	0	0	0
18	1	Garage	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
19	1	Communication	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	24	365	5	414	3,627	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	6	2	32	24	365	5	414	3627	0	0	0
20	1	Communication	Recessed	S	Inc	3	1	90	Sw	12	365	0	270	1,183	CFL	Recessed	CFL	S	Sw	3	1	30	12	365	0	90	394	788	0	788
21	1	Communication closet	Recessed	S	CFL	1	1	13	Sw	1	365	0	13	5	N/A	Recessed	CFL	S	Sw	1	1	13	1	365	0	13	5	0	0	0
22	1	Kitchenette	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	2	365	5	138	101	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	2	2	32	2	365	5	138	101	0	0	0
23	1	Supplies/elect rm	Ceiling Suspended	E	4'T8	1	2	32	Sw	2	365	5	69	50	N/A	Ceiling Suspended	4'T8	E	Sw	1	2	32	2	365	5	69	50	0	0	0
24	1	Storage Closet	Ceiling Mounted	S	Inc	1	1	60	Ct	1	365	0	60	22	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
25	1	Storage Closet	Ceiling Mounted	S	CFL	1	1	13	Sw	1	365	0	13	5	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	1	365	0	13	5	0	0	0
26	1	Garage	Ceiling Mounted	E	4'T8	10	2	32	Sw	12	365	5	690	3,022	N/A	Ceiling Mounted	4'T8	E	Sw	10	2	32	12	365	5	690	3022	0	0	0
27	1	Garage	Ceiling Mounted	E	8'T8	1	2	59	Sw	12	365	7	125	548	N/A	Ceiling Mounted	8'T8	E	Sw	1	2	59	12	365	7	125	548	0	0	0
28	1	Garage	Ceiling Suspended	E	HPS	1	1	200	Sw	12	365	40	240	1,051	T5	Ceiling Suspended	4'T5	E	Sw	1	4	28	12	365	4	116	508	543	0	543
29	1	Garage	Wall Mounted	M	8'T12	2	2	80	Sw	12	365	20	360	1,577	T8	Wall Mounted	8'T8	E	Sw	2	2	59	12	365	7	250	1095	482	0	482
30	1	Storage Rm	Ceiling Suspended	E	4'T8	2	2	32	Sw	1	365	5	138	50	N/A	Ceiling Suspended	4'T8	E	Sw	2	2	32	1	365	5	138	50	0	0	0
31	1	Laundry	Wall Mounted	E	4'T8	1	2	32	Sw	1	365	5	69	25	N/A	Wall Mounted	4'T8	E	Sw	1	2	32	1	365	5	69	25	0	0	0
32	1	Hose tower	Wall Mounted	E	4'T8	2	2	32	Sw	8	365	5	138	403	C	Wall Mounted	4'T8	E	OS	2	2	32	6	365	5	138	302	0	101	101
33	1	Hose tower	Wall Mounted	E	8'T8	1	2	59	Sw	8	365	7	125	365	C	Wall Mounted	8'T8	E	OS	1	2	59	6	365	7	125	274	0	91	91
34	1	Hose tower	Ceiling Mounted	S	CFL	1	1	13	Sw	8	365	0	13	38	C	Ceiling Mounted	CFL	S	OS	1	1	13	6	365	0	13	28	0	9	9
35	2	Office	Ceiling Mounted	S	Inc	1	1	60	Sw	9	365	0	60	197	CFL	Ceiling Mounted	CFL	S	OS	1	1	20	7	365	0	20	49	131	16	148
36	2	Storage Rm	Recessed Parabolic	E	4'T8	3	4	32	Sw	1	365	5	399	146	C	Recessed Parabolic	4'T8	E	OS	3	4	32	1	365	5	399	109	0	36	36
37	2	Dormitory	Recessed Parabolic	E	4'T8	10	4	32	Sw	12	365	5	1,330	5,825	C	Recessed Parabolic	4'T8	E	OS	10	4	32	9	365	5	1330	4369	0	1456	1456
38	2	Dormitory closet	Ceiling Mounted	S	MH	1	1	75	Sw	1	365	21	96	35	CFL	Ceiling Mounted	CFL	S	Sw	1	1	25	1	365	0	25	9	26	0	26
39	2	Dormitory	Recessed Parabolic	E	4'T8	4	4	32	Sw	12	365	5	532	2,330	C	Recessed Parabolic	4'T8	E	OS	4	4	32	9	365	5	532	1748	0	583	583
40	2	Locker Room	Wall Mounted	E	4'T8	4	1	32	Sw	4	365	5	148	216	C	Wall Mounted	4'T8	E	OS	4	1	32	3	365	5	148	162	0	54	54
41	2	Locker Room	Wall Mounted	E	4'T8	4	1	32	Sw	4	365	5	148	216	C	Wall Mounted	4'T8	E	OS	4	1	32	3	365	5	148	162	0	54	54
42	2	Locker Room	Wall Mounted	E	4'T8	4	1	32	Sw	4	365	5	148	216	C	Wall Mounted	4'T8	E	OS	4	1	32	3	365	5	148	162	0	54	54
43	2	Locker Room	Wall Mounted	E	4'T8	4	1	32	Sw	4	365	5	148	216	C	Wall Mounted	4'T8	E	OS	4	1	32	3	365	5	148	162	0	54	54
44	2	Hallway	Ceiling Mounted	E	4'T8	8	2	32	Sw	10	365	5	552	2,015	C	Ceiling Mounted	4'T8	E	OS	8	2	32	8	365	5	552	1511	0	504	504
45	2	Bathroom Men	Recessed	S	CFL	3	1	13	Sw	8	365	0	39	114	C	Recessed	CFL	S	OS	3	1	13	6	365	0	39	85	0	28	28
46	2	Bathroom Men	Recessed	S	Inc	1	1	90	Sw	8	365	0	90	263	CFL	Recessed	CFL	S	OS	1	1	30	6	365	0	30	66	175	22	197
47	2	Bathroom Men	Wall Mounted	M	4'T12	1	1	40	Sw	8	365	12	52	152	T8	Wall Mounted	4'T8	E	OS	1	1	32	6	365	5	37	81	44	27	71
48	2	Showers Men	Recessed	S	CFL	2	1	13	Sw	8	365	0	26	76	C	Recessed	CFL	S	OS	2	1	13	6	365	0	26	57	0	19	19
49	2	Fitness Center	Ceiling Suspended	E	4'T8	3	2	32	Sw	4	365	5	207	302	C	Ceiling Suspended	4'T8	E	OS	3	2	32	3	365	5	207	227	0	76	76
50	2	Conference rm	Recessed Parabolic	E	4'T8 U-Shaped	8	2	32	Sw	4	365	5	552	806	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	8	2	32	3	365	5	552	604	0	201	201
51	2	Kitchen	Recessed Parabolic	E	4'T8 U-Shaped	3	2	32	Sw	10	365	5	207	756	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	3	2	32	8	365	5	207	567	0	189	189
52	2	Kitchen	Recessed Parabolic	E	4'T8	4	4	32	Sw	10	365	5	532	1,942	C	Recessed Parabolic	4'T8	E	OS	4	4	32	8	365	5	532	1456	0	485	485
53	2	Kitchen	Recessed	S	Inc	4	1	90	Sw	10	365	0	360	1,314	CFL	Recessed	CFL	S	OS	4	1	30	8	365	0	120	329	876	110	986
54	2	Closet	Recessed	S	Inc	1	1	90	Sw	1	365	0	90	33	CFL	Recessed	CFL	S	Ct	1	1	30	0	365	0	30	0	22	11	33
55	2	Boiler Rm	Ceiling Mounted	S	CFL	2	1	13	Sw	1	365	0	26	9	C	Ceiling Mounted	CFL	S	OS	2	1	13	1	365	0	26	7	0	2	2
56	2	Boiler Rm	Ceiling Mounted	E	4'T8	2	2	32	Sw	1	365	5	138	50	C	Ceiling Mounted	4'T8	E	OS	2	2	32	1	365	5	138	38	0	13	13
57	Ext	Exterior	Wallpack	S	MH	7	1	150	PC	12	365	42	1,344	5,887	PSMH	Wallpack	PSMH	S	PC	7	1	100	12	365	20	840	3679	2208	0	2208
58	Ext	Exterior	Wallpack	S	Hal	3	1	75	PC	12	365	17	275	1,202	CFL	Wallpack	CFL	S	PC	3	1	25	12	365	0	75	329	874	0	874
59	Ext	Exterior	Spotlight	S	Inc	3	1	90	Sw	12	365	0	270	1,183	CFL	Spotlight	CFL	S	Sw	3	1	30	12	365	0	90	394	788	0	788
Totals:						227	100	2,709				366	17,591	68,211						227	103	#N/A			233	15,365	49,507	8,551	10,153	18,704

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	16,443		
Average Power Cost ($/kWh)	0.1630		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	11,425	6,066	**5,359**
Exterior Power (watts)	2,609	1,385	**1,224**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	56,786	43,441	**13,345**
Lighting Power (watts)	14,983	13,980	**1,003**
Lighting Power Density (watts/SF)	0.91	0.85	**0.06**
Estimated Cost of Fixture Replacement ($)	6,714		
Estimated Cost of Controls Improvements ($)	7,200		
Total Consumption Cost Savings ($)	**4,402**		

Legend							
Fixture Type		**Lamp Type**			**Control Type**	**Ballast Type**	**Retrofit Category**
Ceiling Suspended	Recessed	CFL	3'T12	8'T5	Autom. Timer (T)	S (Self)	N/A (None)
Exit Sign	Sconce	Inc	3'T12 U-Shaped	8'T5 U-Shaped	Bi-Level (BL)	E (Electronic)	T8 (Install new T8)
High Bay	Spotlight	LED	3'T5	8'T8	Contact (Ct)	M (Magnetic)	T5 (Install new T5)
Parabolic Ceiling Mounted	Track	HPS	3'T5 U-Shaped	8'T8 U-Shaped	Daylight & Motion (M)		CFL (Install new CFL)
Parabolic Ceiling Suspended	Vanity	MH	3'T8	Circline - T5	Daylight & Switch (DLSw)		LEDex (Install new LED Exit)
Pendant	Wall Mounted	MV	3'T8 U-Shaped	Circline - T8	Daylight Sensor (DL)		LED (Install new LED)
Recessed Parabolic	Wall Suspended	1'T12	4'T5	Circline - T12	Delay Switch (DSw)		D (De-lamping)
Ceiling Mounted	Wallpack	1'T12 U-Shaped	4'T5 U-Shaped	Fl.	Dimmer (D)		C (Controls Only)
Chandelier		1'T5	6'T12	Hal	Motion Sensor (MS)		PSMH (Install new Pulse-Start Metal Halide)
Equipment / Fume Hood		1'T5 U-Shaped	6'T12 U-Shaped	Induction	Motion& Switch (MSw)		
Flood		1'T8	6'T5	Infrared	None (N)		
Landscape		1'T8 U-Shaped	6'T5 U-Shaped	LPS	Occupancy Sensor (OS)		
Low Bay		2'T12 U-Shaped	6'T8	Mixed Vapor	Occupancy Sensor - CM (OSCM)		
Parabolic Wall Mounted		2'T5	6'T8 U-Shaped	Neon	Photocell (PC)		
Pole Mounted		2'T5 U-Shaped	8'T12	Quartz Halogen	Switch (Sw)		
Pole Mounted Off Building		2'T8 U-Shaped	8'T12 U-Shaped				

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

JCP&LELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.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 Corp.** 300 Madison Avenue MorrisSummit, NJ 0113113 (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	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 MorrisSummit, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (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 The Mac-Cali Building 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) 800-756-3749 www.south jerseyenergy.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 MooresSummit, NJ 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 545 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-53-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com

APPENDIX D: 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 measure (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.

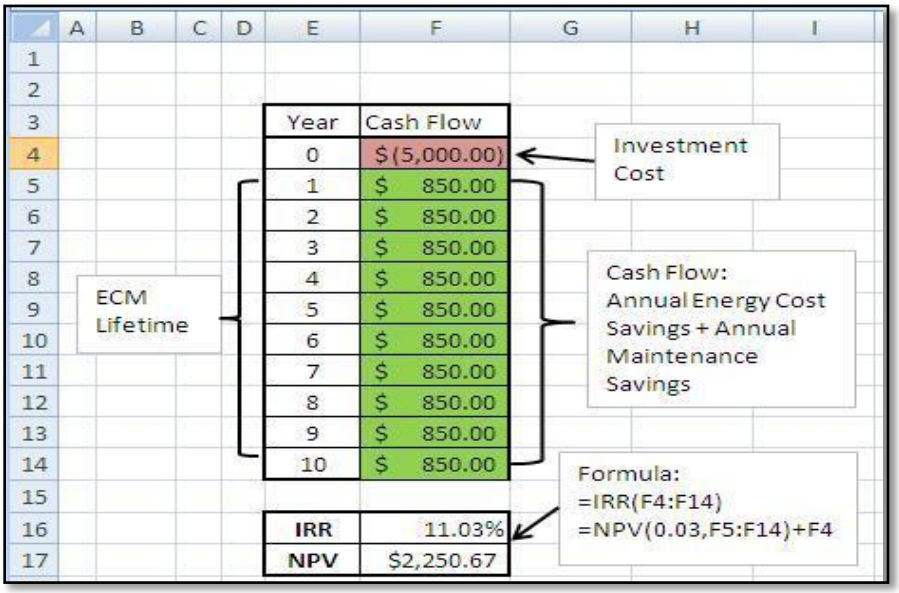
Calculation References

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
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/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 + $600/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 & Industrial Lifetimes

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 E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
City of Summit - Fire Department

Building ID: 2408794
For 12-month Period Ending: June 30, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: August 20, 2010

Facility
City of Summit - Fire Department
396 Broad Street
Summit, NJ 07901

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1948
Gross Floor Area (ft²): 16,443

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	596,176
Natural Gas (kBtu)[4]	1,662,915
Total Energy (kBtu)	2,259,091

Energy Intensity[5]

Site (kBtu/ft²/yr)	137
Source (kBtu/ft²/yr)	227

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	179

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	45%
Building Type	Fire Station/Police Station

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[6] **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. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. 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 F: 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.

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

Direct Install 2010 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 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, PSE&G

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

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.

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.

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 G: 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	Upgrade (6) Thermostats to Programmable Type	1,002	0	1,002	2,572	0.0	1,571	10.1	1,458	3,793	12	45,513	0.3	4,442	370	379	35,178	21,918
2	(23) New CFL Fixtures to be Installed	868	0	868	4,411	0.9	0	0.9	1,091	1,810	5	9,049	0.5	942	188	208	7,144	7,898
3	(1) New T5 Fixtures to be Installed	210	16	194	543	0.1	0	0.1	150	239	15	3,578	0.8	1,744	116	123	2,532	972
4	Replace (6) Old Engine Bay Hydronic and Steam Ceiling Hung Heaters with (6) 60,000 Btu/hr Infrared Heaters	7,200	1,800	5,400	741	0.0	1,179	7.3	105	1,663	20	33,268	3.2	516	26	31	18,310	14,322
5	(4) New T8 Fixtures to be installed	649	60	589	601	0.1	0	0.1	67	165	15	2,480	3.6	321	21	27	1,314	1,076
6	Install (36) Occupancy Sensors	7,920	720	7,200	10,142	2.1	0	2.1	0	1,653	15	24,796	4.4	244	16	22	11,872	18,159
7	Replace (1) Refrigerator with 18 cu ft ENERGY STAR Model	750	0	750	454	0.0	0	0.1	50	124	12	1,488	6.1	98	8	13	455	813
8	Install 30 kW Solar Photovoltaic System	210,000	22,500	187,500	35,400	30.0	0	7.3	0	26,767	25	669,182	7.0	257	10	12	152,939	63,384
9	(12) New PSMH Fixtures to be Installed	5,363	300	5,063	2,996	0.6	0	0.6	48	536	15	8,038	9.4	59	4	6	1,204	5,364
10	Replace Old Boiler and HVAC System with (2) Condensing Furnaces and High Efficiency AC Condensers	72,000	1,844	70,156	3,451	0.1	774	5.4	2,700	4,206	15	63,085	16.7	-10	-1	-1	-20,026	14,707

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions, E-Quest
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.