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November 8, 2010

Local Government Energy Program
Energy Audit Final Report

City of Orange Township

Fire Headquarters
419 Central Avenue
Orange, NJ 07050

Project Number: LGEA68

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EXECUTIVE SUMMARY

The City of Orange Township Fire Headquarters is a two story building with a full basement comprising a total conditioned floor area of 30,000 square feet. The original structure was built in 1917, and there have been several renovations over the past 30 years. The following chart provides an overview of current energy usage in the building based on the analysis period of May 2009 through April 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	152,820	11,211	40,449	55	1,643
Proposed	91,072	10,785	29,344	47	1,390
Savings	61,748	426	11,105	8.4	253
% Savings	40%	4%	27%	15%	15%

There may be energy procurement opportunities for the City of Orange Township Fire Headquarters to reduce annual utility costs, which are $3,209 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Fire Headquarters in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This fire station is comprised of non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the City of Orange Township Fire Headquarters is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 55.0 kBtu/ft^2-yr compared to the national average of "Other" space type fire stations consuming 78.0 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.

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	5,236	1.8	4,916	21,355
5-10 Year	4,041	5.3	21,435	27,808
Renewable	22,445	7.0	156,250	40,415
Total	29,184	5.4	156,351	89,578

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 7 cars from the roads each year or avoiding the need of 218 trees to absorb the annual CO_2 generated.

Other recommendations to increase building efficiency pertaining to operations and maintenance and capital improvements are listed below:

Further Recommendations:

SWA recommends that the City of Orange Township Fire Headquarters further explore the following:

- Capital Improvements
  - Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives
  - Seal open hose hoist shaft leading to roof
  - Properly seal roof overhand along entire exterior wall surface.
  - SWA recommends professional inspection of base moisture seepage issues in basement
  - Replace all original, single-glazed windows and frames with historically and architecturally accurate low-E, double glazed type
  - Upgrade laundry equipment with ENERGY STAR® or most efficient available
- Operations and Maintenance
  - Apply water sealer to moldy/leaking, below-grade slab
  - Replace and maintain caulk around existing skylights
  - Install and maintain weather-stripping around all exterior doors and roof hatches.
  - Maintain roofs
  - Maintain downspouts and cap flashing
  - Provide weather-stripping/air-sealing
  - Repair/seal wall cracks and penetrations
  - Provide water-efficient fixtures and controls
  - SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances
  - Use smart power electric strips
  - Create an energy educational program

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Orange Township. Based on the requirements of the LGEA program, City of Orange Township 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 $926.50

Financial Incentives and Other Program Opportunities

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

Table 3: Next Steps for the Municipal Building

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Install Sixteen (16) New Occupancy Sensors	Smart Start
Install One Hundred and Thirty (130) New T8 Fluorescent Fixtures	Smart Start
Retrofit two (2) Existing Vending Machines with VendingMiser™ Devices	Direct Install
Install a 25 kW Solar Photovoltaic Rooftop System	Smart Start, Renewable Energy Incentive Program

There are various incentive programs that the City of Northfield could apply for that could help lower the cost of installing the ECMs. For the Municipal Building, and contingent upon available funding, SWA recommends the following incentive programs:

Direct Install 2010 Program: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.

OR

Smart Start : Majority of energy saving equipment and design measures have moderate incentives under this program.

OR

Renewable Energy Incentive Program: Receive up to $0.75/Watt toward installation cost for PV panels upon available funding.

AND

For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.

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, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 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 Headquarters at 419 Central Avenue. The process of the audit included facility visits on March 19 and April 22, 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 Orange Township to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Fire Headquarters.

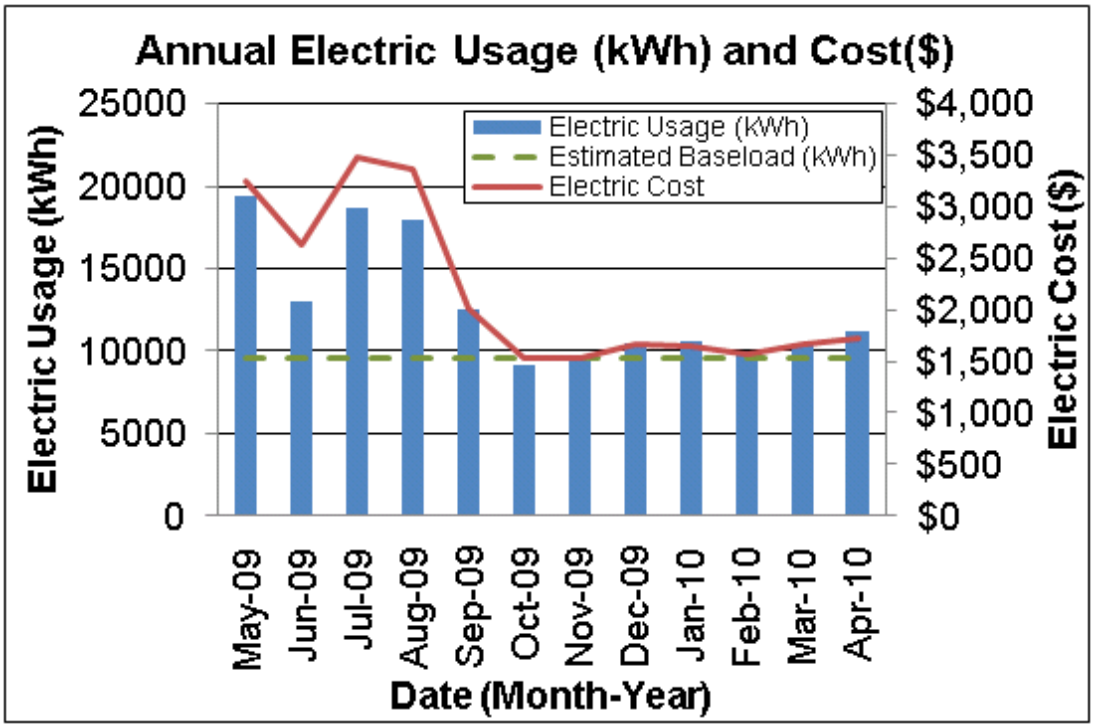
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from May 2008 through April 2010 that were received from the utility companies supplying the Fire Headquarters with electric and natural gas. A 12 month period of analysis from May 2009 through April 2010 was used for all calculations and for purposes of benchmarking the building.

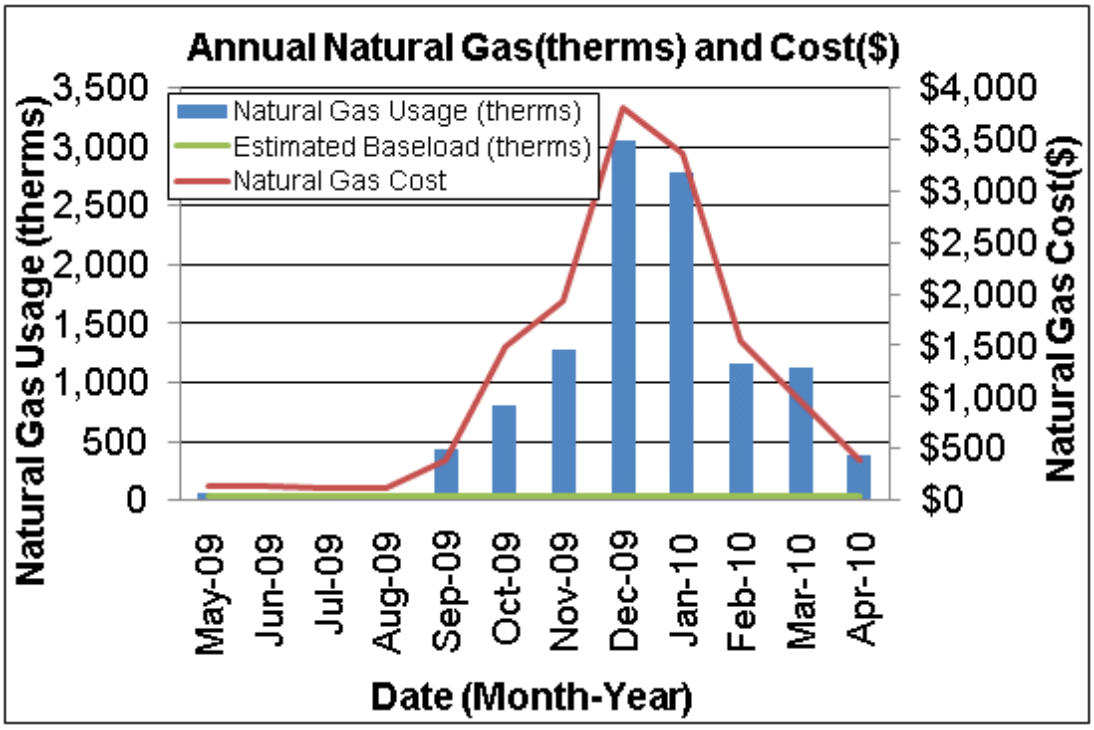
Electricity - The Fire Headquarters is currently served by one electric meter. The Fire Headquarters currently buys electricity from PSE&G at **an average aggregated rate of $0.171/kWh**. The Fire Headquarters purchased **approximately 152,820 kWh, or $26,068 worth of electricity,** in the previous year. The average monthly demand was 37.8 kW and the annual peak demand was 45.3 kW.

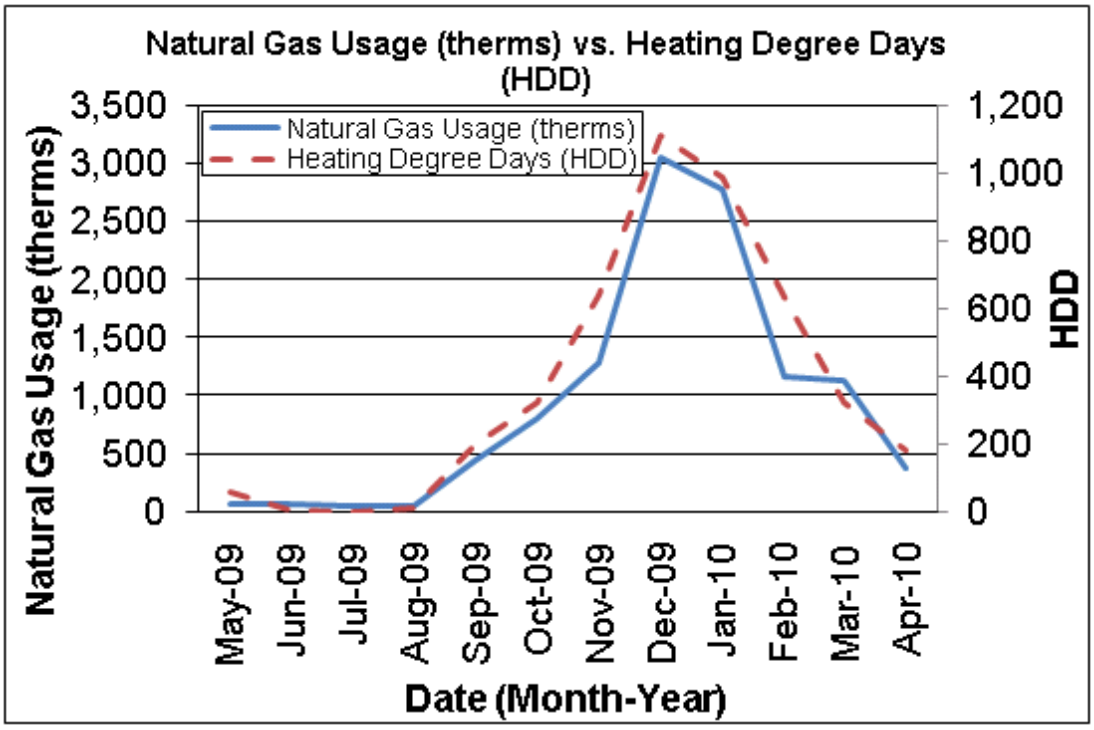
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Fire Headquarters.



Natural gas - The Fire Headquarters is currently served by one meter for natural gas. The Fire Headquarters currently buys natural gas from PSE&G at **an average aggregated rate of $1.283/therm**. The Fire Headquarters purchased **approximately 11,211 therms, or $14,381 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the Fire Headquarters.

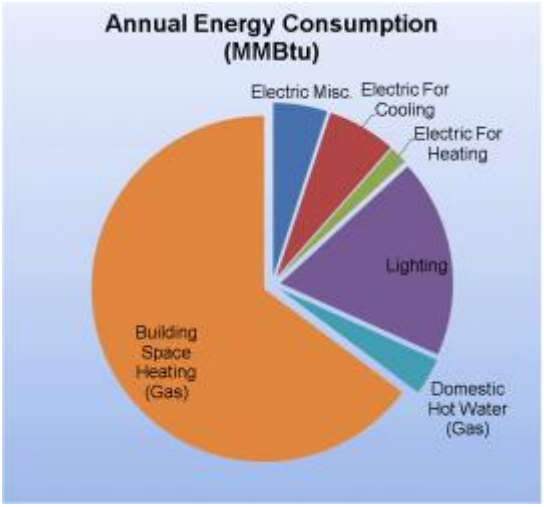


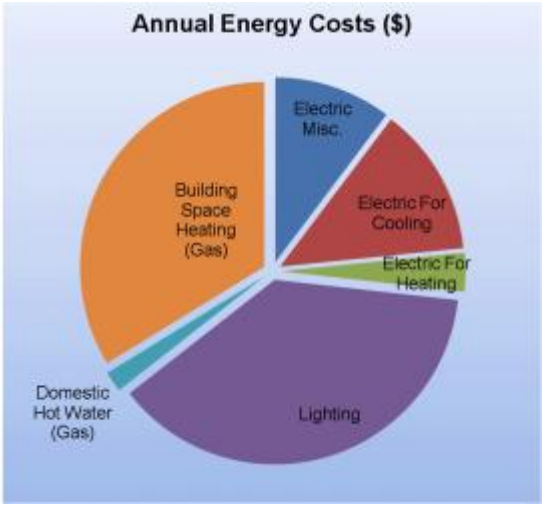


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the City of Orange Township Fire Headquarters based on utility bills for the 12 month period. Note: electrical cost at $50/MMBtu of energy is almost four times as expensive as natural gas at $13/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	354	22%	$17,701	44%	50
Electric For Cooling	106	6%	$5,295	13%	50
Electric For Heating	27	2%	$1,366	3%	50
Lighting	34	2%	$1,706	4%	50
Domestic Hot Water (Gas)	57	3%	$729	2%	13
Building Space Heating (Gas)	1,064	65%	$13,652	34%	13
Totals	1,643	100%	$40,449	100%	
Total Electric Usage	521	32%	$26,068	64%	50
Total Gas Usage	1,121	68%	$14,381	36%	13
Totals	1,643	100%	$40,449	100%	



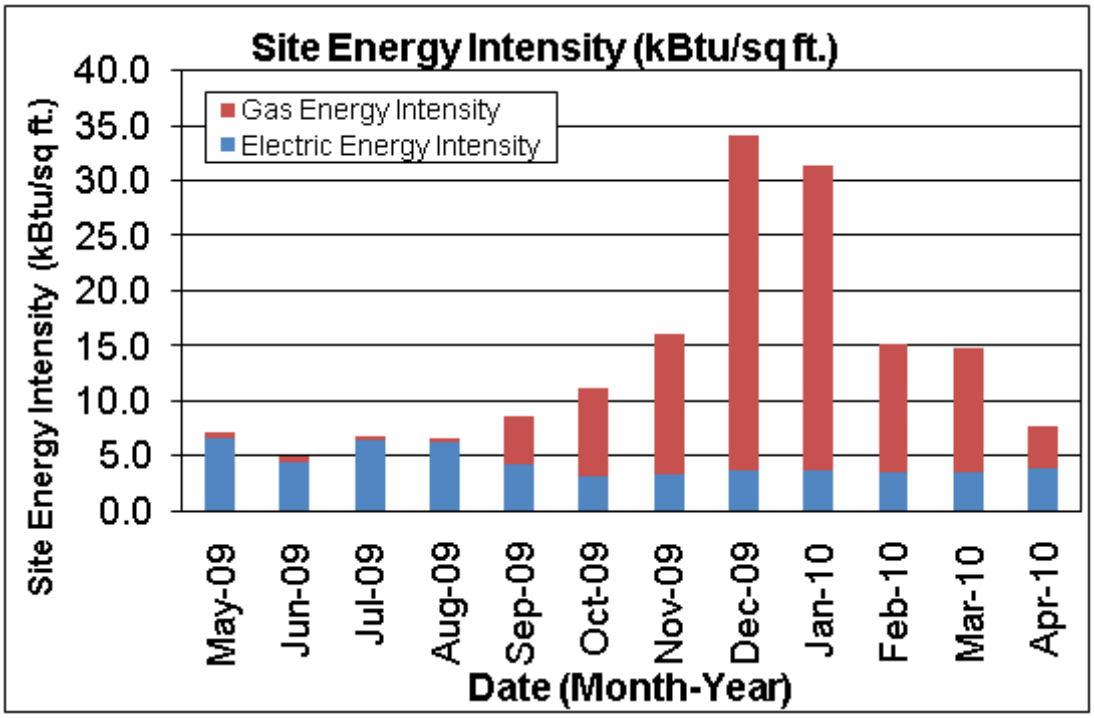


Energy benchmarking

SWA has also entered energy information about the Fire Headquarters in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This fire station is comprised of non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the City of Orange Township Fire Headquarters is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 55.0 kBtu/ft^2-yr compared to the national average of "Other" space type fire stations consuming 78.0 kBtu/ft^2-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 "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the City of Orange Township 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 Orange Township to create an *ENERGY STAR® Portfolio Manager* account and share the Fire Headquarters 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 Orange Township [redacted]

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 City of Orange Township 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 hot water 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 through the window air conditioning units.

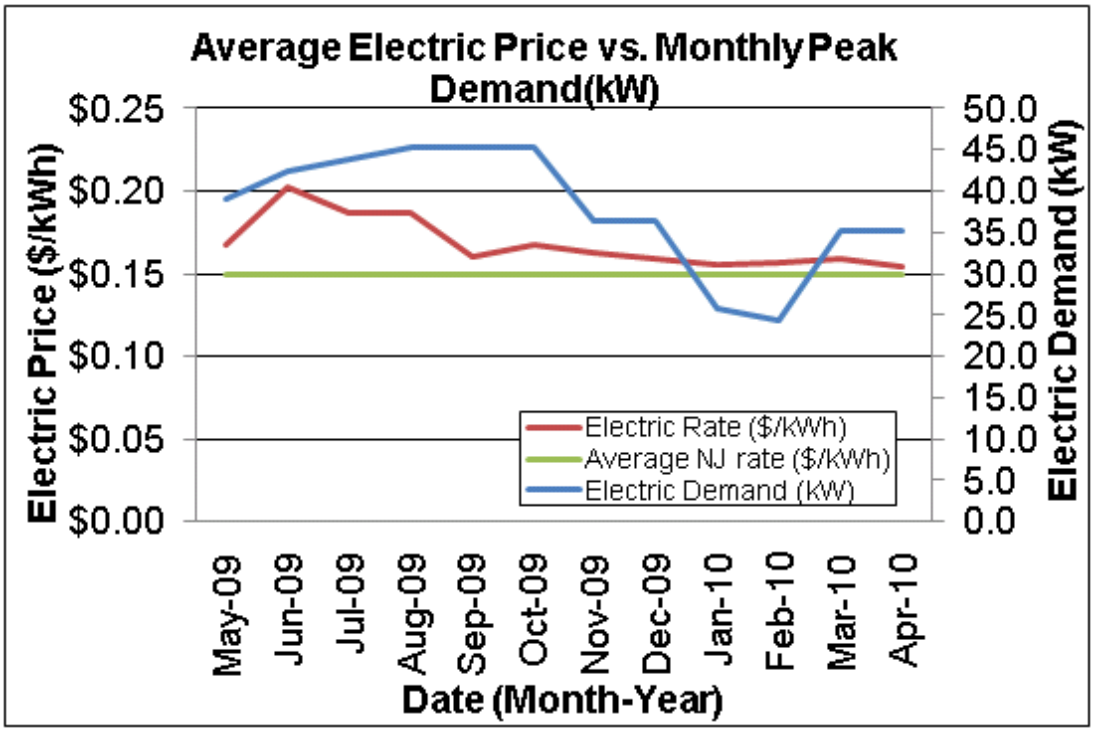
The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the City of Orange Township is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus 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. There general service rate for electric charges are market-rate based on use. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

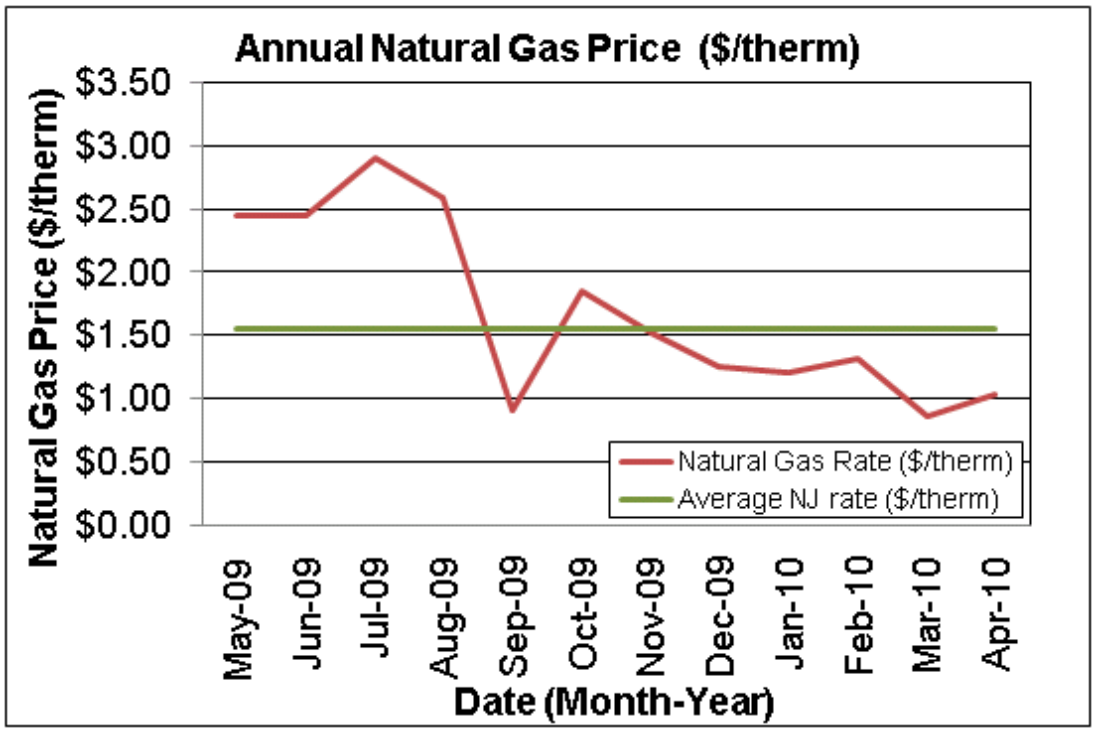
Energy Procurement strategies

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 Headquarters pays a rate of $0.171/kWh. The Fire Headquarters annual electric utility costs are $3,209 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 24% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm; while the Fire Headquarters pays a competitive rate of $1.283/therm. Natural gas bill analysis shows fluctuations up to 70% 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 Headquarters 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 Headquarters. Appendix C contains a complete list of third-party energy suppliers for the City of Orange Township service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

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

Based on visits from SWA on April 22, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story (including a full basement), 30,000 square feet Central Fire Headquarters Building was originally constructed in 1917 with several renovations over the past 30 years. It houses eight truck bays with a combination of fire engines and fire trucks, storage area, kitchen area, offices, sleeping quarters, storage basement and patrol areas.

Front Façade

Rear Façade

Right Side Façade

Left Side Façade

Building Occupancy Profiles

The building is always open 24 hours a day, seven days a week. Its occupancy is approximately 17 employees daily from 8:00am and 6:00pm and 10 employees at all other times.

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.

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

Exterior Walls

The exterior wall envelope is mostly constructed of 18" of solid brick and some precast concrete accents with no wall insulation. The interior is mostly painted brick.

Note: Wall insulation levels could not be verified in the field and are based on reports from building management.

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

Roof

The building's roof is predominantly a flat and parapet type over wood framing, with a dark-colored EPDM single membrane finish. It was replaced approximately two years ago. No ceiling insulation, and two inches of foam board roof insulation were recorded.
Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

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

The following specific roof problem spots were identified:

Open shaft on roof to 1st floor garage area, which brings in cold air. Only barrier is a poorly insulated door on the first floor.

Eave is separating from exterior wall.

Base

The building's base is composed of a below grade slab floor with a perimeter footing with solid brick foundation walls and no detectable slab edge insulation.

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in poor condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in the basement.

The following specific base problem spots were identified:

Water/moisture seepage through cracks detected in the slab

Water/moisture seepage through cracks detected in the slab

Water seepage from ground water

Windows

The building contains several different types of windows:

1. 38 double-hung type windows with a non-insulated aluminum or wood frame, clear single glazing. The windows are located throughout the building and were installed approximately 20 years ago. There are interior roller blinds on the second floor, no shading on the first floor

2. Two awning type windows with a non-insulated aluminum frame, clear single glazing and interior roller blinds. The windows are located throughout the building and were installed approximately 20 years ago

3. Two operable skylight type window assemblies with a non-insulated aluminum frame, single pane, wire mesh safety glazing and no interior or exterior shading devices. The windows are located on the roof and were installed approximately 20 years ago

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in poor condition with numerous signs of uncontrolled air-leakage.

The following specific window problem spots were identified:

Single-glazed window with ineffective frame, difficult to open

Single-glazed window with ineffective frame

Air-leakage at sleeved window/wall air-conditioning units

Single-glazed skylight, with ineffective frame

Exterior doors

The building contains several different types of exterior doors:

1. Three metal type exterior doors. They are located on the main floor and were replaced approximately 15 years ago

2. Two wood type exterior doors. They are located on the main floor and are original

3. Eight aluminum garage bay type doors with six glass lights per door. They are located on the main floor and were replaced approximately six years ago

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 poor condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Aged wood type door with no weather stripping

Missing weather-stripping on exterior door

Missing/worn weather-stripping

Missing weather-stripping on exterior door

Damaged door frame

Building air-tightness

Overall the field auditors found the building to be not adequately air-tight with numerous 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 City of Orange Township Fire Headquarters is cooled by eleven window-mounted air conditioners and heated by a natural gas fired steam boiler which supplies steam to radiators throughout the building and baseboards in the first floor meeting room. The building is primarily naturally ventilated and additional ventilation is provided by inducing fresh air through the building via 6 exhaust fans, a kitchen exhaust fan and through a vehicle exhaust system in the garage. A comprehensive Equipment List can be found in Appendix A.

Equipment

The City of Orange Township Fire Headquarters is cooled by eleven window-mounted air conditioners. They serve the various offices throughout the building, dorm room and gym. Of these 11 air conditioners, only one is an ENERGY STAR® qualified unit and several of them are improperly sealed in their respective windows. These units vary in size from 8,000 Btuh to 36,000 Btuh and EER ratings of 9.2 – 10.8. The larger 36,000 Btuh 9.2 EER units are located in the dorm area while the smaller and more efficient units serve the offices.

Space heating is provided by a steam boiler manufactured by Weil McLain, model # 88, series # 2. The boiler is installed with a PowerFlame dual fuel burner, which has an output of 2,369 MBH. The boiler was installed in 2009 and has approximately 96% of its estimated remaining useful life remaining and the primary fuel source for this unit is natural gas.

There are various roof mounted exhaust systems throughout the firehouse including a 10 HP vehicle exhaust system with approximately 70% of its estimated remaining useful life remaining, six exhaust vents with approximately 90% of its estimated remaining useful life remaining and a kitchen exhaust fan with approximately 30% of its estimated remaining useful life remaining.

Distribution Systems

There is no distribution system for the buildings cooling equipment as they are all direct vent through the window units. Steam heat is distributed through radiators located throughout the building and a baseboard located in the first floor meeting room. Hot water is distributed by uninsulated copper piping.

Controls

The space heating system is controlled by one manual non-programmable thermostat permanently set to 68^{o}F. Several of the cooling units are also equipped with there own manual thermostats.

Domestic Hot Water

The domestic hot water (DHW) for the Fire Headquarters is provided by a natural gas atmospheric water heater manufactured by A.O. Smith. It is part of their Promax series, Model #PCV 50 100. The heaters capacity is 50 gallons with an input of 40,000 Btuh and 40.94 gal/hr recovery rate.

This heater was installed in 2003 has 53% estimated useful operating life remaining and appears in good condition.

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.

Interior Lighting - The Fire Headquarters currently contains mostly fixtures with electronically ballasted T12 lamps and a couple of electronically ballasted T8 lamps, chandeliers and wall sconces with self-ballast bulbs. 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 incandescent fixtures. Exterior lighting is controlled by switches.

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.

There are four refrigerators installed in the fire headquarters in the buildings kitchen, recreation room and garage area. All of the units were recently installed, and although only one of them is ENERGY STAR® qualified, the other units are all efficient newer models whose replacement with an ENERGY STAR® unit is not cost effective. There are also two older model refrigerated vending machines installed in the garage that should be retrofitted with VendingMiser™ devices. Other appliances installed include a commercial washing machine and dryer. The washing machine was manufactured by Alliance Laundry Systems, and is model # VW35 P20U70001. The dryer was manufactured by Leeson, and is model # 0182K34FB20.

Elevators

The Fire Headquarters does not have an installed elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Fire Headquarters.

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 are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

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

Based on utility analysis and a study of roof conditions, the Fire Headquarters is a good candidate for a 25 kW Solar Panel installation. See ECM #6 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.

Geothermal

The Fire Headquarters is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have upwards of 90% remaining useful life.

Combined Heat and Power

The Fire Headquarters is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload 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#	0-5 Year Payback ECMs
1	Install Sixteen (16) New CFL Fixtures
2	Upgrade Space Heating Control with Programmable Thermostat
3	Install Sixteen (16) New Occupancy Sensors
4	Retrofit Two (2) Existing Vending Machines with VendingMiser™ Devices
	5-10 Year Payback ECMs
5	Install One Hundred and Thirty (130) New T8 Fluorescent Fixtures
7	Replace Two (2) Existing Air Conditioners with an Energy Star Model
	Renewable Energy ECMs
6	Install 25 kW Solar PV System

ECM#1: Install Sixteen (16) New CFL Fixtures

On the day of the site visit, SWA completed a lighting inventory of the City of Orange Township Fire Headquarters (see Appendix B). The existing lighting inventory contained a total of 16 inefficient incandescent lamps. SWA recommends that each incandescent and halogen 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.

Installation cost:

Estimated installed cost: $443 (includes $182 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
443	1,854	0.4	N/A	0.2	108	425	5	2,126	1.0	380	76	92	1,493	2,540

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#2: Upgrade Space Heating Control with Programmable Thermostat

During the field audit, SWA completed a building HVAC controls analysis and observed that space heating in the building is controlled by a manually thermostat in the upper floor office that is constantly set to 68^{o}F. SWA recommends replacing this unit with a programmable thermostat. 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 4% per year). The savings from using a programmable thermostat is greater in milder climates than in more extreme climates. 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: $875 (includes $394 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
875	0	0	426	7.2	0	547	12	6,559	1.6	650	54	62	5,556	4,984

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 40 min/wk to make manual adjustments vs. an installed programmable thermostat. 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.

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 Sixteen (16) New Occupancy Sensors

On the days of the site visits, SWA completed a lighting inventory of the City of Orange Township Fire Headquarters (see Appendix B). The building contains ten areas that could benefit from the installation of sixteen occupancy sensors. These areas consisted of various offices, meeting rooms, lounges, mechanical rooms and recreational rooms that could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced micro-phonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $3,200 (includes $460 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
3,200	9,368	2.0	N/A	1.1	0	1,602	15	24,029	2.0	651	43	50	15,650	12,834

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

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors ($20 per control)*

Please see Appendix F for more information on Incentive Programs.

ECM#4: Retrofit Two (2) Existing Vending Machines with VendingMiser™ Devices

A simple plug and play device the VendingMiser™ device is compatible with refrigerated vending machines. It utilizes Passive Infrared Sensors (PIR) to help the vending machine save power. This unit is to be installed on the existing refrigerated vending machines.

Installation cost:

Estimated installed cost: $398 (Includes $40 of labor)
Source of cost estimate: *Manufacturers info*

Economics:

Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
398	728	0.1	N/A	0.1	0	124	5	622	3.2	56	11	31	1,067	997

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Average weekly operating hours = 84.

Rebates/financial incentives:

NJ Clean Energy – Direct Install (Up to 60% of installed cost)

Please see Appendix F for more information on Incentive Programs.

ECM#5: Install One Hundred and Thirty (130) New T8 Fluorescent Fixtures

On the day of the site visit, SWA completed a lighting inventory of the City of Orange Township Fire Headquarters (see Appendix B). The existing lighting inventory contained one hundred and thirty 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 a T12 fixture with magnetic ballast.

Installation cost:

Estimated installed cost: $20,915 (includes $4,875 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
20,915	19,938	4.2	N/A	2.3	570	3,979	15	59,684	5.3	185	12	17	25,905	27,315

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 - T8 fixtures with electronic ballasts ($15 per fixture)

Please see Appendix F for more information on Incentive Programs.

ECM #6: Install 25 kW Solar PV System

SWA presents below the economics, and recommends at this time that the City of Orange Fire Headquarters further review installing a 25 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. As an electricity supplier, reducing the Borough's electric load allows for more capacity for the town and also serves as an example of energy efficiency for the community.

The size of the system was determined using the amount of roof surface area as a limiting factor, as well as the facilities annual base load. A PV system could be installed on a portion of the sloped roof that faces South or West. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 25 kW system needs approximately 204 panels, which would occupy 2,183 square feet, or 22% of the current roof area.

Installation cost: Estimated installed cost: $150,000 (includes $50,000 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
156,250	29,500	25	0	3.4	0	22,445	25	561,125	7.0	259	10	12	130,252	40,415	156,250	29,500

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 (123 Watts, Model ND-123UJF). PV systems are sized based on 25,000 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 50 kW or less. Incentive amount for this application is $18,750. 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 of $17,400/year, based on $600/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.*

ECM#7: Replace Two (2) Existing Air Conditioners with Energy Star Models

Description:

On the day of the site visit, SWA observed that there were two old air conditioners in the building, which were not Energy Star rated. Appliances, such as air conditioners, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. Besides saving energy through the efficiency of the units they also come equipped with more accurate controls and will reduce infiltration losses if installed properly as compared to the current installations which are substandard. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings and more information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $520 (includes $120 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
7	520	360	0.2	N/A	0.1	0	62	15	923	8.4	78	5	8	204	493

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

Rebates/financial incentives:

- There are no other incentives at this point in time.

Options for Funding ECM:

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 Headquarters:

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.
- Seal open hose hoist shaft leading to roof to avoid unconditioned air circulating to occupied space.
- Properly seal roof overhand along entire exterior wall surface.
- SWA recommends professional inspection of base moisture seepage issues in basement.
- Replace all original, single-glazed windows and frames with historically and architecturally accurate low-E, double glazed type.
- Upgrade laundry equipment with ENERGY STAR® or most efficient available - Replace existing washing machine with ENERGY STAR® qualified unit when it has reached the end of its useful operating life and dryer with the most energy efficient unit available since ENERGY STAR® does not qualify dryers when it has reached the end of its useful operating life.

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.

- Apply water sealer to moldy/leaking, below-grade slab.
- Replace and maintain caulk around existing skylights.
- Install and maintain weather-stripping around all exterior doors and roof hatches.
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.
- 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 - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. 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 weep holes, 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. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

- 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/.

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Orange Township. Based on the requirements of the LGEA program, City of Orange Township 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 $926.50.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	Weil-McLain steam boiler with PowerFlame dual fuel burner	Basement	Weil-McLain, Model 88, Series 2, Serial #NA	N. Gas	All Areas	2009	96%
Heating	PowerFlame dual fuel burner, 2,369 MBH output with GE motor	Basement	PowerFlame, Model #CR2-00-20A, Serial #019569719	N. Gas	All Areas	2009	96%
Heating	GE motor on PowerFlame burner, 1 HP, 3,450 RPM, 60 Hz, 1 ph	Basement	GE, Model #5KC39RN44GX, Catalog #C334	Electricity	All Areas	2009	96%
Heating	Marathon supply pump motor, 1/3 HP, 3,450 RPM, DP enclosure, 1 phi	Basement	Marathon Electric, Part #DM0 005, Model #HQF 56C34D1200HP	Electricity	All Areas	2009	90%
Cooling	GE, Quiet-Aire energy saver winow AC unit, not sealed well	Office	GE, Quiet-Aire Energy Saver, Model #30137329, Serial #NA	Electricity	Office		
Cooling	AC-1; Friedrich, 36,000 Btuh cooling, 9.2 EER	Dorm area, left side	Friedrich, Model #SL36L30-A, Serial #LEFR01801	Electricity	Dorm Area		
Cooling	AC-2; Friedrich, 36,000 Btuh cooling, 9.2 EER	Dorm area, right side	Friedrich, Model #SL36L30-A, Serial #LEFR01817	Electricity	Dorm Area		
Cooling	Friedrich window AC unit, 9.7 EER, 18,000 Btuh cooling, 1,050W	Recreational Room	Friedrich, Model #CP18N30, Serial #LGECR00507	Electricity	Rec. Room	2007	90%
Cooling	Frigidaire, Energy Star window AC unit, 9.4 EER	Office	Frigidaire, Model #FAS156N1A, Serial #EK35044946	Electricity	Office	2007	90%
Cooling	Frigidaire Electrolux energy saver window AC unit, no nameplate info	Gym	Frigidaire, Electrolux, Model #NA, Serial #NA	Electricity	Gym		
Cooling	Small unknown window AC unit in small office in basement	Small office in basement	Unknown	Electricity	Small office in basement	2009	90%

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Frigidaire window AC unit, no nameplate info	Office	Frigidaire, Model #NA, Serial #NA	Electricity	Office		
Cooling	Carrier window AC unit, old, sealed with duct tape, no nameplate info	Office	Carrier, Model #NA, Serial #NA	Electricity	Office		
Cooling	Airtemp window AC unit, 8,000 Btuh, 9.8 EER	Office	Airtemp, Model #B6X08F2A, Serial #CS 131029 085Y	Electricity	Office		
Cooling	Frigidaire window AC unit, 8,000 Btuh cooling, 10.8 EER	Dispatch	Frigidaire, Model #FAC085M7A1, Serial #JK32826570	Electricity	Dispatch		
Exhaust System	Weg motor for truck exhaust system, 3 ph induction, 10 HP, 3,520 RPM, TEFL encl.	Exhaust system on roof	Weg, Model #BL-10-36-215T, Serial #NA	Electricity	Truck exhaust	2007	70%
Ventilation	6 Active Ventilation Products exhaust vents, www.roofvents.com, no nameplate info	Roof	Active Ventilation Products, Model #NA, Serial #NA	Electricity	All Areas	2009	90%
Ventilation	Ansam Kitchen and Ventilation Corp., exhaust air fan	Roof	Ansam Kitchen Corp., Model #NCA14FA, Job #215532, Fan #0	Electricity	Kitchen	2003	30%
Domestic Hot Water	AO Smith atmospheric water heater, 50 gallons, 40,000 Btuh input, 40.94 gal/hr recovery, uses 254 therms/year	Basement	AO Smith, Promax, Model #PCV 50 100, Serial #AM030019870	N. Gas	All Areas	2003	53%
Appliances	Baldor motor on compressor for filling oxygen tanks, 7.5 HP, 3,450 RPM, 60 Hz, 87% NEMA nom. Efficiency, 3ph	Compressor room, garage area	Baldor, Catalog #M3219T, Serial #F282, Spec #36B01-194	Electricity	Compressor		
Appliances	Wood's reach-in freezer, R134B refrigerant, 312 kWh/year, energy star	Garage Area	Wood's, Model #C10NAA, Serial #09336858MJ	Electricity	Garage	2002	68%
Appliances	Hotpoint (GE) refrigerator, 479 kWh/year	Garage Area	Hotpoint (GE), Model #CTX14CYTDRWH, Serial #RL790313	Electricity	Garage		
Appliances	1 refrigerated "drink" vending machine	Garage Area	No nameplate info	Electricity	Garage		

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Appliances	Amana commercial refrigerator, 535 kWh/year	Kitchen	Amana, Model #ARB2217CSL, Serial #11515316EA, Mfg #PARB2217CS2	Electricity	Kitchen		
Appliances	Leeson motor on electric dryer, 3HP, 3,500 RPM, TEFL encl., NEMA nom. Efficiency 80%	Garage Area	Leeson, Model #0182K34FB20, Serial #NA	Electricity	Electric Dryer		
Appliances	Alliance Laundry Systems, commercial washer for Fire Equipment, 3 ph	Garage Area	Alliance Laundry Systems, Model #VW35 P20U70001, Serial #3030329596	Electricity	Washer		
Appliances	Frigidaire refrigerator, 479 kWh/year	Recreational Room	Frigidaire, Model #FRT8S6ESBG, Serial #BA73432707	Electricity	Rec. Room	2007	88%
Lighting	See Appendix A	-	-	-	-	-	-

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	2	Gymnasium	Recessed	M	4'T12	12	4	40	Sw	9	365	12	2,064	6,780	T8	Recessed	4'T8	E	OS	12	4	32	7	365	5	1596	3932	1537	1311	2848
2	2	Training Room	Recessed	M	4'T12	12	4	40	Sw	9	365	12	2,064	6,780	T8	Recessed	4'T8	E	OS	12	4	32	7	365	5	1596	3932	1537	1311	2848
3	2	Gymnasium	Exit Sign	S	LED	1	0	5	Sw	24	365	1	1	4	N/A	Exit Sign	LED	S	Sw	1	0	5	24	365	1	1	4	0	0	0
4	2	Hallway	Exit Sign	S	LED	2	0	5	Sw	24	365	1	1	9	N/A	Exit Sign	LED	S	Sw	2	0	5	24	365	1	1	9	0	0	0
5	2	Hallway	Ceiling Suspended	M	4'T12 U-Shaped	11	2	40	Sw	16	365	12	1,012	5,910	T8	Ceiling Suspended	4'T8 U-Shaped	E	Sw	11	2	32	16	365	5	759	4433	1478	0	1478
6	2	Office Area	Recessed Parabolic	M	4'T12	3	4	40	Sw	9	365	12	516	1,695	T8	Recessed Parabolic	4'T8	E	Sw	3	4	32	9	365	5	399	1311	384	0	384
7	2	Lounge	Recessed Parabolic	M	4'T12	6	4	40	Sw	8	365	12	1,032	3,013	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	6	365	5	798	1748	683	583	1266
8	2	Lounge	Exit Sign	S	LED	1	1	5	Sw	24	365	1	6	48	N/A	Exit Sign	LED	S	Sw	1	1	5	24	365	1	6	48	0	0	0
9	2	Lounge	Ceiling Mounted	S	Inc	2	1	60	Sw	24	365	0	120	1,051	CFL	Ceiling Mounted	CFL	S	Sw	2	1	20	24	365	0	40	350	701	0	701
10	2	Bathroom Women	Recessed Parabolic	M	4'T12	1	4	40	Sw	9	365	12	172	565	T8	Recessed Parabolic	4'T8	E	Sw	1	4	32	9	365	5	133	437	128	0	128
11	2	Bathroom Men	Recessed Parabolic	M	4'T12	3	4	40	Sw	9	365	12	516	1,695	T8	Recessed Parabolic	4'T8	E	OS	3	4	32	7	365	5	399	983	384	328	712
12	2	Sleeping quarters	Parabolic Ceiling Suspended	M	4'T12	4	2	40	Sw	16	365	12	368	2,149	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	4	2	32	16	365	5	276	1612	537	0	537
13	2	Sleeping quarters rooms (1)	Parabolic Ceiling Suspended	M	4'T12	1	4	40	Sw	16	365	12	172	1,004	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	16	365	5	133	777	228	0	228
14	2	Sleeping quarters rooms (1)	Parabolic Ceiling Suspended	S	Inc	1	1	60	Sw	16	365	0	60	350	CFL	Parabolic Ceiling Suspended	CFL	S	Sw	1	1	20	16	365	0	20	117	234	0	234
15	2	Sleeping quarters rooms (2)	Parabolic Ceiling Suspended	M	4'T12	1	4	40	Sw	16	365	12	172	1,004	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	16	365	5	133	777	228	0	228
17	2	Sleeping quarters rooms (3)	Parabolic Ceiling Suspended	M	4'T12	1	4	40	Sw	16	365	12	172	1,004	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	16	365	5	133	777	228	0	228
19	2	Sleeping quarters rooms (4)	Parabolic Ceiling Suspended	M	4'T12	1	4	40	Sw	16	365	12	172	1,004	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	16	365	5	133	777	228	0	228
21	2	Locker Room	Ceiling Mounted	M	8'T12	1	4	80	Sw	9	365	20	340	1,117	T8	Ceiling Mounted	8'T8	E	Sw	1	4	59	9	365	7	243	798	319	0	319
22	2	Locker Room	Ceiling Mounted	M	4'T12	1	4	40	Sw	9	365	12	172	565	T8	Ceiling Mounted	4'T8	E	Sw	1	4	32	9	365	5	133	437	128	0	128
23	2	Sleeping quarters	Exit Sign	S	LED	2	1	5	Sw	24	365	1	11	96	N/A	Exit Sign	LED	S	Sw	2	1	5	24	365	1	11	96	0	0	0
24	2	Office	Recessed Parabolic	M	4'T12	3	4	40	Sw	24	365	12	516	4,520	T8	Recessed Parabolic	4'T8	E	OS	3	4	32	18	365	5	399	2621	1025	874	1899
25	2	Office	Recessed Parabolic	M	4'T12	6	4	40	Sw	24	365	12	1,032	9,040	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	18	365	5	798	5243	2050	1748	3797
26	2	Office	Recessed Parabolic	M	4'T12	5	4	40	Sw	24	365	12	860	7,534	T8	Recessed Parabolic	4'T8	E	OS	5	4	32	18	365	5	665	4369	1708	1456	3165
27	2	Office	Recessed Parabolic	M	2'T8	4	4	17	Sw	24	365	2	280	2,453	C	Recessed Parabolic	2'T8	M	OS	4	4	17	18	365	2	280	1840	0	613	613
28	2	Office	Recessed Parabolic	M	2'T8	4	4	17	Sw	24	365	2	280	2,453	C	Recessed Parabolic	2'T8	M	OS	4	4	17	18	365	2	280	1840	0	613	613
29	2	Storage Rm	Ceiling Suspended	M	4'T12	2	2	40	Sw	2	365	12	184	134	T8	Ceiling Suspended	4'T8	E	Sw	2	2	32	2	365	5	138	101	34	0	34
30	2	Storage Rm	Ceiling Mounted	M	8'T12	2	2	80	Sw	2	365	20	360	263	T8	Ceiling Mounted	8'T8	E	Sw	2	2	59	2	365	7	250	183	80	0	80
31	2	Storage Rm	Ceiling Mounted	M	8'T12	2	2	80	Sw	2	365	20	360	263	T8	Ceiling Mounted	8'T8	E	Sw	2	2	59	2	365	7	250	183	80	0	80
32	2	Hallway	Recessed Parabolic	M	4'T12	2	4	40	Sw	16	365	12	344	2,009	T8	Recessed Parabolic	4'T8	E	Sw	2	4	32	16	365	5	266	1553	456	0	456
33	2	Staircase	Recessed Parabolic	M	4'T12	2	2	40	Sw	16	365	12	184	1,075	T8	Recessed Parabolic	4'T8	E	Sw	2	2	32	16	365	5	138	806	269	0	269
34	1	Truck Bay	Ceiling Mounted	M	8'T12	15	2	80	Sw	12	365	20	2,700	11,826	T8	Ceiling Mounted	8'T8	E	Sw	15	2	59	12	365	7	1875	8213	3614	0	3614
35	1	Truck Bay	Recessed Parabolic	M	4'T12	4	4	40	Sw	12	365	12	688	3,013	T8	Recessed Parabolic	4'T8	E	Sw	4	4	32	12	365	5	532	2330	683	0	683
36	1	Meeting Rm	Recessed Parabolic	M	4'T12	4	4	40	Sw	8	365	12	688	2,009	T8	Recessed Parabolic	4'T8	E	Sw	4	4	32	8	365	5	532	1553	456	0	456
37	1	Meeting Rm	Ceiling Mounted	S	Inc	6	1	60	Sw	8	365	0	360	1,051	CFL	Ceiling Mounted	CFL	S	Sw	6	1	20	8	365	0	120	350	701	0	701
38	1	Bathroom Men	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	365	12	344	1,130	T8	Recessed Parabolic	4'T8	E	Sw	2	4	32	9	365	5	266	874	256	0	256
39	Bsmt	Storage Rm	Ceiling Mounted	M	4'T12	13	1	40	Sw	2	365	12	676	493	T8	Ceiling Mounted	4'T8	E	Sw	13	1	32	2	365	5	481	351	142	0	142
40	Bsmt	Storage Rm	Ceiling Mounted	S	Inc	3	1	60	Sw	2	365	0	180	131	CFL	Ceiling Mounted	CFL	S	Sw	3	1	20	2	365	0	60	44	88	0	88
41	Bsmt	Storage Rm	Ceiling Mounted	M	8'T12	2	2	80	Sw	2	365	20	360	263	T8	Ceiling Mounted	8'T8	E	Sw	2	2	59	2	365	7	250	183	80	0	80
42	Bsmt	Storage Rm	Ceiling Suspended	M	8'T12	1	4	80	Sw	2	0	20	340	0	T8	Ceiling Suspended	8'T8	E	Sw	1	4	59	2	0	7	243	0	0	0	0
43	Bsmt	Storage Rm	Ceiling Suspended	M	4'T12	1	4	40	Sw	2	0	12	172	0	T8	Ceiling Suspended	4'T8	E	Sw	1	4	32	2	0	5	133	0	0	0	0
44	Ext	Exterior	Wall Mounted	S	Inc	3	1	60	PC	12	0	0	180	0	CFL	Wall Mounted	CFL	S	PC	3	1	20	12	0	0	60	0	0	0	0
45	1	Patrol Area	Recessed Parabolic	M	4'T12	2	2	40	Sw	8	0	12	184	0	T8	Recessed Parabolic	4'T8	E	Sw	2	2	32	8	0	5	138	0	0	0	0
46	1	Storage Rm	Recessed Parabolic	M	4'T12 U-Shaped	2	2	40	Sw	2	0	12	184	0	T8	Recessed Parabolic	4'T8 U-Shaped	E	Sw	2	2	32	2	0	5	138	0	0	0	0
47	1	Truck Bay	Exit Sign	S	LED	2	1	5	Sw	24	365	1	11	96	N/A	Exit Sign	LED	S	Sw	2	1	5	24	365	1	11	96	0	0	0
48	1	Compressor Rm	Ceiling Suspended	M	8'T12	1	4	80	Sw	24	365	20	340	2,978	T8	Ceiling Suspended	8'T8	E	OS	1	4	59	18	365	7	243	1597	850	532	1382
49	1	Kitchen	Ceiling Suspended	M	4'T12	1	4	40	Sw	9	365	12	172	565	T8	Ceiling Suspended	4'T8	E	Sw	1	4	32	9	365	5	133	437	128	0	128
50	1	Kitchen	Ceiling Mounted	S	Inc	1	1	60	Sw	9	365	0	60	197	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	9	365	0	20	66	131	0	131
Totals:						162	130	2,059				471	21,181	89,345						162	130				191	15,641	58,185	21,792	9,368	31,160
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	30,000		
Average Power Cost ($/kWh)	0.1710		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	0	0	**0**
Exterior Power (watts)	180	60	**120**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	89,345	58,185	**31,160**
Lighting Power (watts)	21,001	15,581	**5,420**
Lighting Power Density (watts/SF)	0.70	0.52	**0.18**

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 (Delamping)
Ceiling Mounted	Wallpack	1'T12 U-Shaped	4'T5 U-Shaped	FI.	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

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Third Party Gas Suppliers for PSEG Service Territory	**Telephone & Web Site**
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 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	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
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.

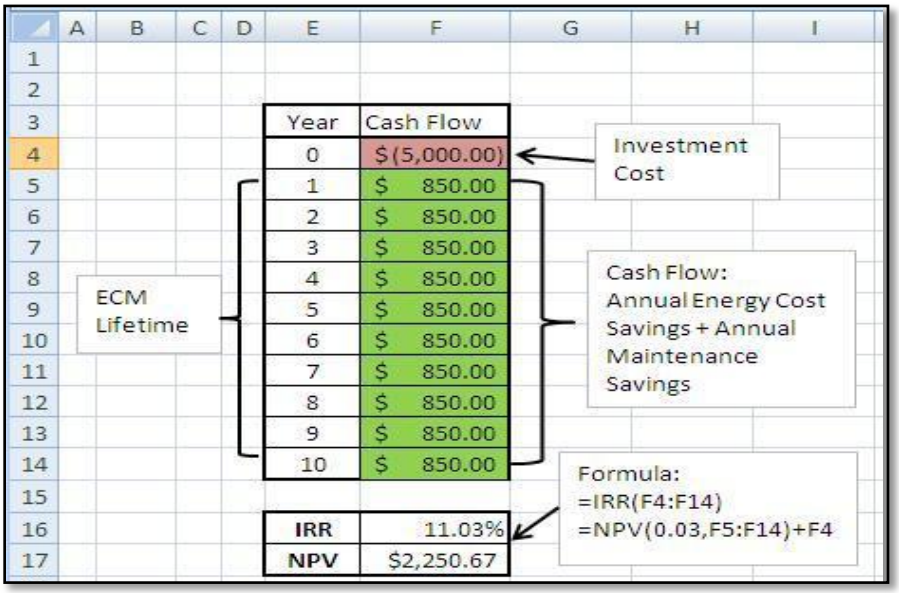
Calculation References

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 Orange Township - Fire Headquarters

Building ID: 2341569
For 12-month Period Ending: April 30, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: July 12, 2010

Facility
City of Orange Township - Fire Headquarters
428 Central Ave.
Orange, NJ 07050

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1917
Gross Floor Area (ft²): 30,000

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	513,471
Natural Gas (kBtu)[4]	1,122,209
Total Energy (kBtu)	1,635,680

Energy Intensity[5]	
Site (kBtu/ft²/yr)	55
Source (kBtu/ft²/yr)	96

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	138

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-39%
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. Theincentives 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, South Jersey Gas

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/.

APPENDIX G: VendingMiser™ Energy Savings Calculator

EnergyMisers

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

Savings Calculator

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

Energy Costs ($0.000 per kWh)	.171
Facility Occupied Hours per Week	84
Number of Cold Drink Vending Machines	2
Number of Non-refrigerated Snack Machines	0
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	0
VendingMiser® Sale Price (for cold drink machines)	199
SnackMiser™ Sale Price (for snack machines)	0

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	1747	1019	728	42%
Cost of Operation	$298.77	$174.28	$124.49	42%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	0	0	0	NaN%
Cost of Operation	$0	$0	$0	NaN%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	1747	1019	728	42%
Cost of Operation	$298.77	$174.28	$124.49	42%

Total Project Cost	Break Even (Months)
$398	38.37

Estimated Five Year Savings on ALL Machines = $622.44

APPENDIX H: ENERGY CONSERVATION MEASURES

	ECM #	ECM description	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
0-5 Year Payback ECMs	1	**Install Sixteen (16) New CFL Fixtures**	None at this time	443	1,854	0.4	N/A	0.2	108	425	5	2,126	1.0	380	76	92	1,493	2,540
	2	**Upgrade Space Heating Control with Programmable Thermostat**	None at this time	875	0	0	426	7.2	0	547	12	6,559	1.6	650	54	62	5,556	4,984
	3	**Install Sixteen (16) New Occupancy Sensors**	320	3,200	9,368	2.0	N/A	1.1	0	1,602	15	24,029	2.0	651	43	50	15,650	12,834
	4	**Retrofit Two (2) Existing Vending Machines with VendingMiser™ Devices**	None at this time	398	728	0.1	N/A	0.1	0	124	5	622	3.2	56	11	31	1,067	997

	ECM #	ECM description	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
5-10 Year Payback ECMs	5	**Install One Hundred and Thirty (130) New T8 Fluorescent Fixtures**	1,950	20,915	19,938	4.2	N/A	2.3	570	3,979	15	59,684	5.3	185	12	17	25,905	27,315
	7	**Replace Two (2) Existing Air Conditioners with an Energy Star Model**	None at this time	520	360	0.2	N/A	0.1	0	62	15	923	8.4	78	5	8	204	493
Renewable Energy ECMs	6	**Install 25 kW Solar PV System**	18,750	156,250	29,500	25.0	0	3.4	0	22,445	25	561,125	7.0	259	10	12	130,252	40,415

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

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions
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.