Steven Winter Associates, Inc. 293 Route 18, Suite 330 Telephone (866) 676-1972
Building Systems Consultants East Brunswick, NJ 08816 Facsimile (203) 852-0741
www.swinter.com

August 20, 2010

Local Government Energy Program
Energy Audit Final Report

City of Elizabeth

Police Department Headquarters
1 Police Plaza
Elizabeth, NJ 07201

Project Number: LGEA57

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EXECUTIVE SUMMARY

The City of Elizabeth Police Department Headquarters is a two-story with partial basement building comprising a total conditioned floor area of 82,427 square feet. The original structure was built in 1987, with one alteration in 2002. The following chart provides an overview of current energy usage in the building based on the analysis period of February 2009 through February 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	2,325,303	63,060	409,543	155.0	14,240
Proposed	1,525,009	30,050	255,152	81.8	8,208
Savings	800,294	33,010	154,391	73.2	6,032
% Savings	34	52	38	47	42

*The Solar Photovoltaic system recommendation is excluded from this table

**Total Annual Cost savings are equal to energy cost savings plus incurred operations and maintenance savings

Table 2: Proposed Photovoltaic System

Initial Investment, $	Total Recommended System Capacity (kW)	Electricity Generated, (kWh/year)	Demand Reduction (kW)	SRECs earned (SRECs/year)	Total Revenue ($/year)
678,500	135.7	152,828	22.9	152	113,107

*Revenue generated from producing electricity and collecting Solar Renewable Energy Credits (SRECs) has been factored into the total revenue

There may be energy procurement opportunities for the City of Elizabeth Police Department Headquarters to reduce annual utility costs, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Police Department Headquarters in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. The Police Department Headquarters is comprised of non-eligible ("Police Station") space type and as a result of being a "non-eligible" space type; a performance score could not be generated. Although a performance score could not be generated, the software was able to generate site energy use intensity. Compared to a typical Police Department building that uses 78.0 kBtu/sqft-yr, the City of Elizabeth Police Department Headquarters used 155.0 kBtu/sqft-yr.

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 and Table 2. The measures are categorized by payback period in Table 3 below:

Table 3: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	46,544	0.3	15,614	577,982
5-10 Year	66,352	5.8	385,500	776,569
>10 year	41,495	14.7	610,922	442,245
Solar PV	113,207	6.3	678,500	273,639
Total	267,598	6.3	1,690,536	2,070,434

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 172 cars from the roads each year or avoiding the need of 5,042 trees to absorb the annual CO_2 generated.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Elizabeth. Based on the requirements of the LGEA program, City of Elizabeth 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 $2,574.75.

Financial Incentives and Other Program Opportunities

There are various incentive programs that the City of Elizabeth could apply for that could help lower the cost of installing the ECMs. Please refer to Appendix F for details.

SWA recommends that the City of Elizabeth implement all recommended Energy Conservation Measures at the Police Department Headquarters. SWA recommends that the City of Elizabeth first address all lighting upgrades including occupancy sensors since these will ultimately affect the heating load within the building. Once lighting upgrades are complete, the City of Elizabeth should implement all HVAC related measures. All HVAC related measures, including boiler replacement, chiller replacement, unit heater replacement and pump replacements should be performed before the installation of the Building Automation System. The Building Automation System will help coordinate all related building systems and should correctly address building controls based on actual heating and cooling loads. The roof should undergo a structural analysis before the installation of the Solar PV system. Further funding opportunities are currently available for implementation of this scope of work through the NJ Office of Clean Energy's SmartStart and Pay-for-Performance programs. There are also funding opportunities available through the Renewable Energy Incentive Program (REIP) as well as possible funding through the appropriate utility companies.

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.

For this project, PMK Group, Inc., a business unit of Birdsall Services Group (BSG-PMK), worked as a sub-contractor in conjunction with Steven Winter Associates, Inc. (SWA).

SWA and PMK Group, Inc., performed an energy audit and assessment for the Police Department Headquarters at 1 Police Plaza, Elizabeth, NJ. The process of the audit included facility visits on 3/17 and 3/18, 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 Elizabeth to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Police Department Headquarters.

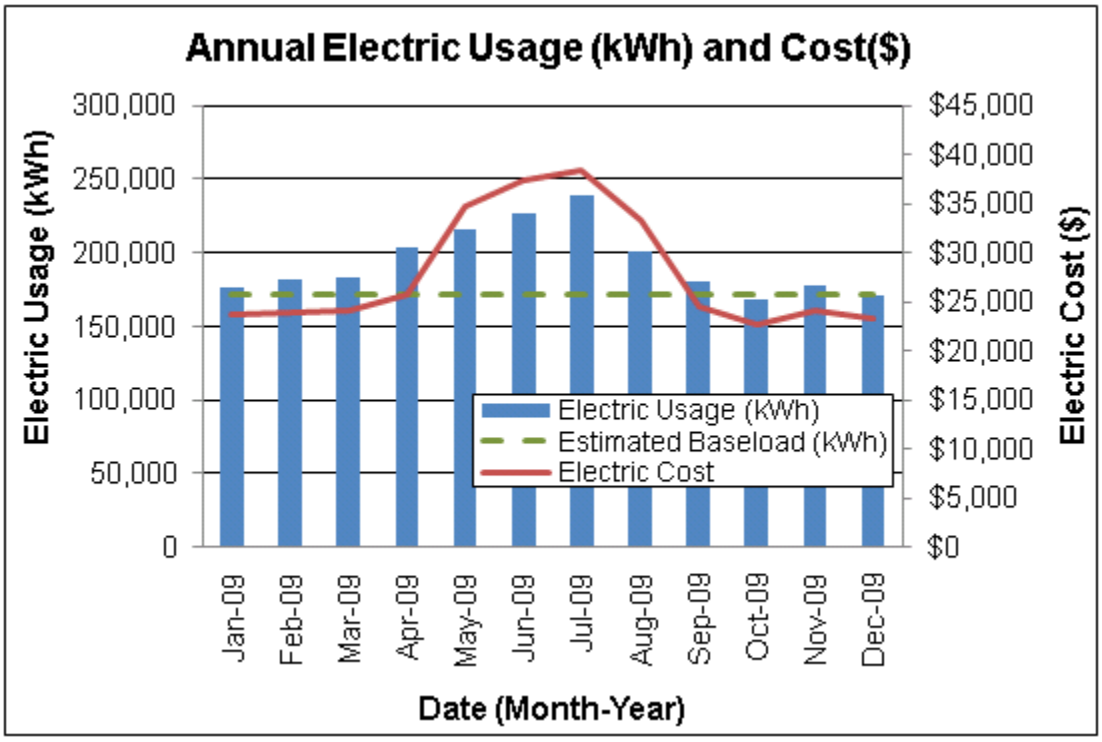
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

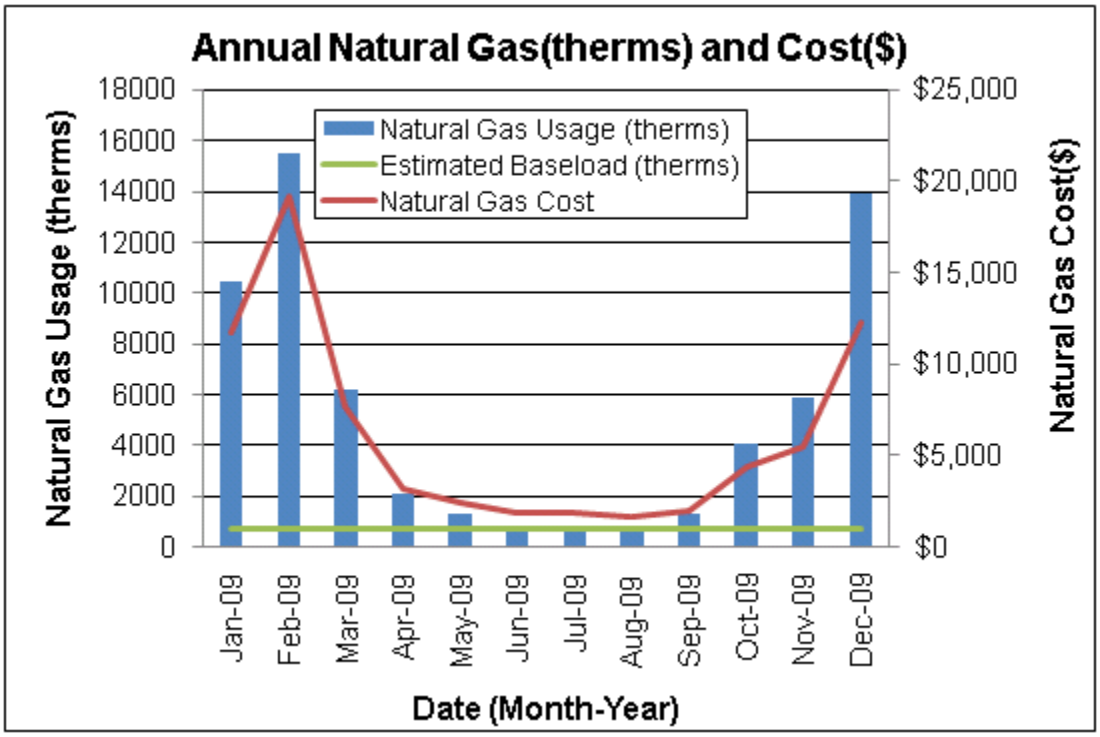
Electricity - The Police Department Headquarters is currently served by one electric meter. The building currently buys electricity from PSE&G at **an average aggregated rate of $0.144/kWh**. The Police Department Headquarters purchased **approximately 2,325,303 kWh, or $335,857 worth of electricity,** in the previous year. The average monthly demand was 347.4 kW and the annual peak demand was 423.6 kW.

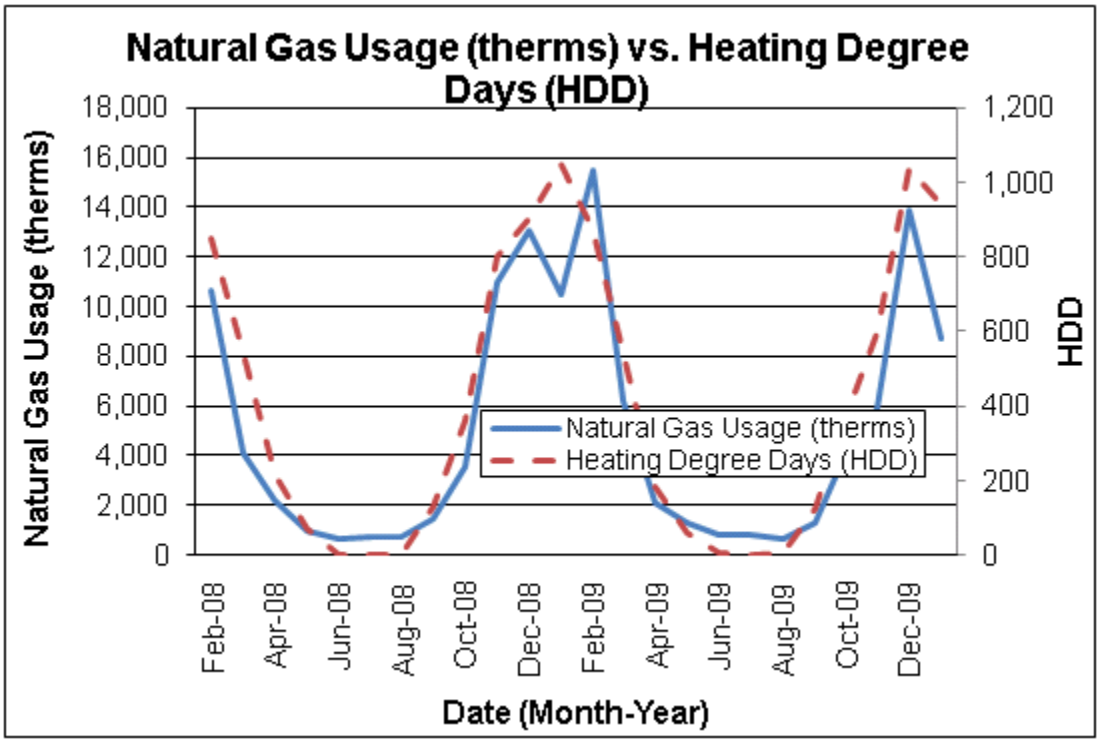
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Police Department Headquarters.



Natural gas - The Police Department Headquarters is currently served by two meters for natural gas. The building currently buys natural gas from Elizabethtown Gas at **an average aggregated rate of $1.169/therm**. The Police Department Headquarters purchased **approximately 63,060 therms, or $73,686 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 Police Department Headquarters.



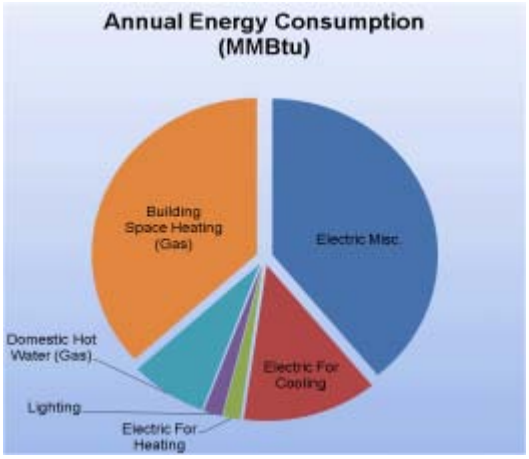


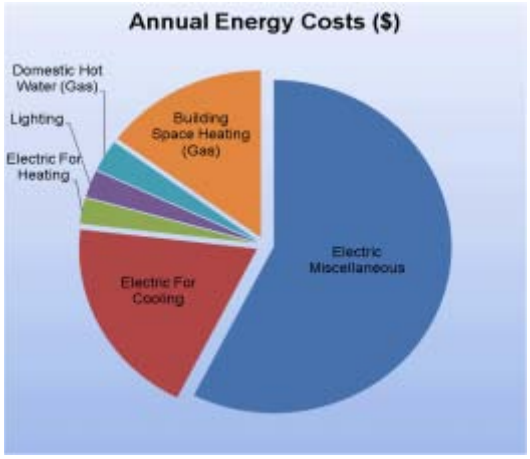
The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the

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 Police Department Headquarters based on utility bills for the 12 month period. Note: electrical cost at $42/MMBtu of energy is almost 4 times as expensive as natural gas at $12/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	5,557	39%	$235,235	57%	42
Electric For Cooling	1,879	13%	$79,541	19%	42
Electric For Heating	242	2%	$10,244	3%	42
Lighting	256	2%	$10,837	3%	42
Domestic Hot Water (Gas)	1,071	8%	$12,515	3%	12
Building Space Heating	5,235	37%	$61,171	15%	12
Totals	14,240	100%	$409,543	100%	
Total Electric Usage	7,934	56%	$335,857	82%	42
Total Gas Usage	6,306	44%	$73,686	18%	12
Totals	14,240	100%	$409,543	100%	

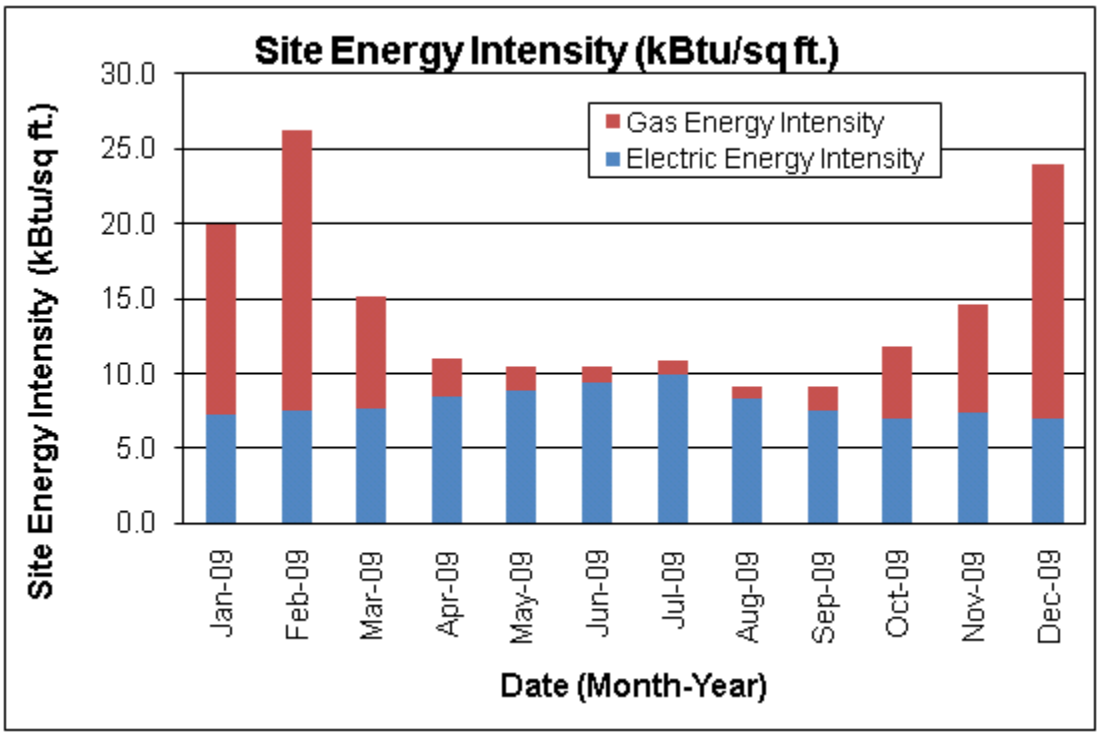




Energy benchmarking

SWA has entered energy information about the Police Department Headquarters in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. The Police Department Headquarters facility is categorized as a non-eligible ("Police Department") space type. Because it is a "non-eligible" space type, there is no rating available. Consequently, the Police Department Headquarters is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 155.0 kBtu/ft^2-yr compared to the national average of a typical Police Department building 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 “Police Department” space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the City of Elizabeth 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 Elizabeth to create an *ENERGY STAR® Portfolio Manager* account and share the Police Department facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the City of Elizabeth ([redacted] and TRC Energy Services [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.

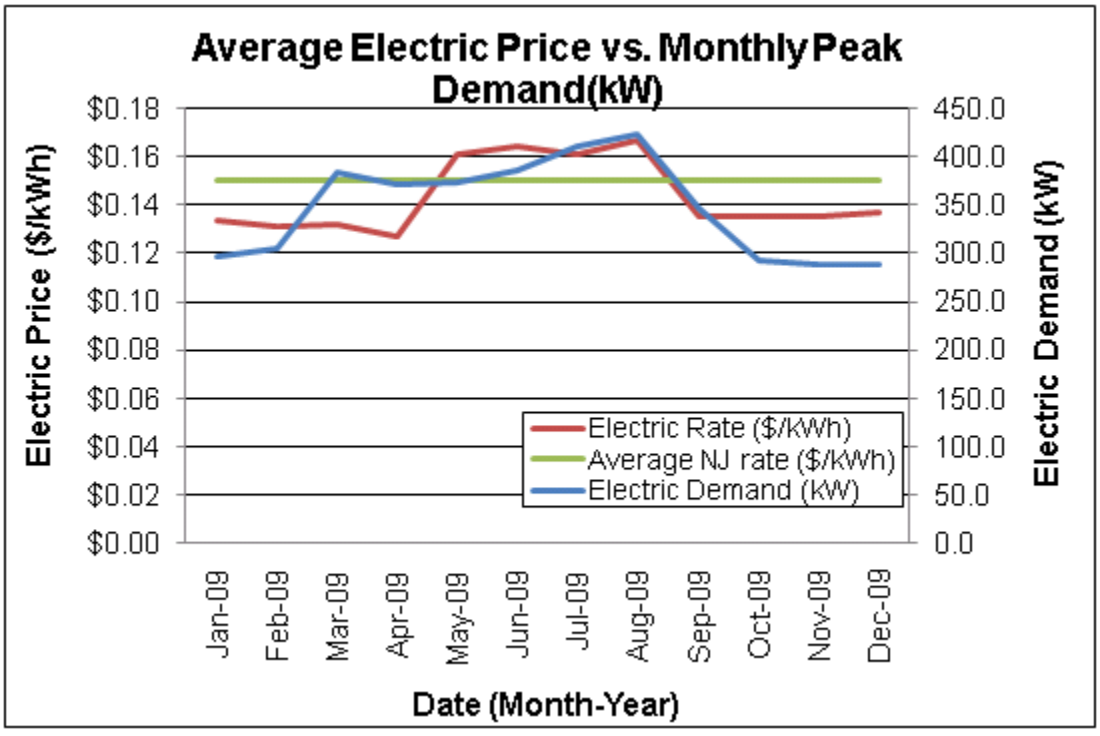
Tariff analysis is performed to determine if the rate that a municipality is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used 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 HVAC package units with DX cooling, electric chillers and split AC system 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 Elizabeth is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

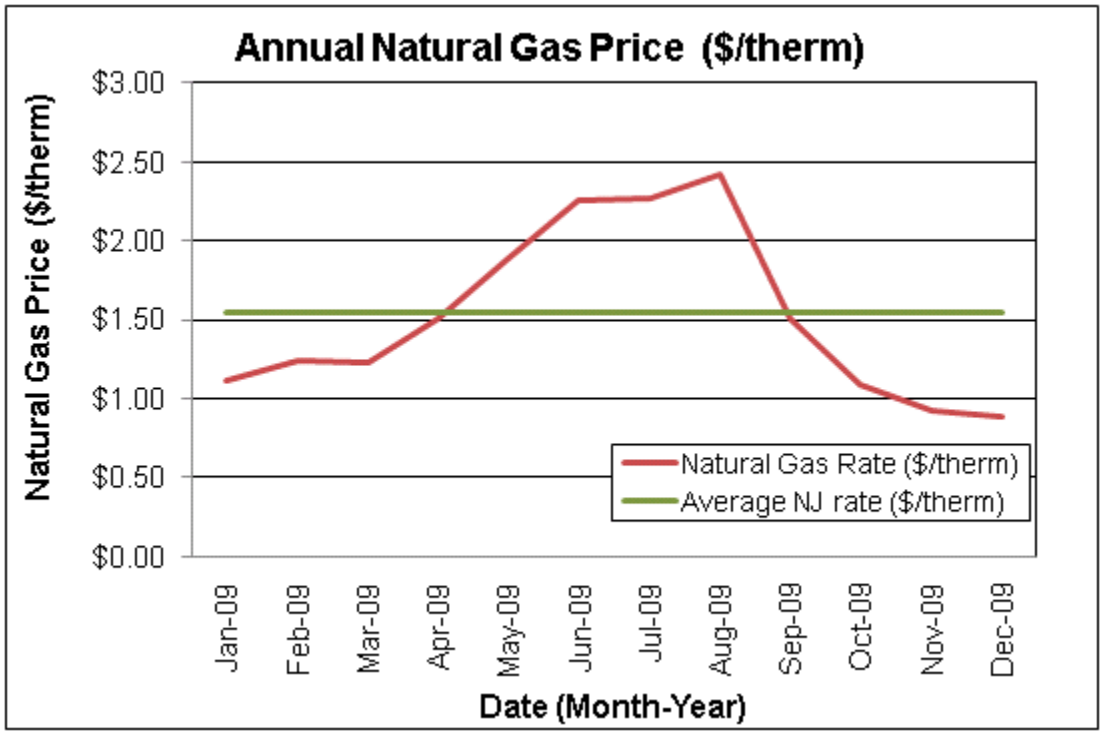
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while the Police Department Headquarters pays a rate of $0.144/kWh. The Police Department Headquarters annual electric utility costs are lower, 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 Police Department Headquarters pays a rate of $1.169/therm. Natural gas bill analysis shows fluctuations up to 64% 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 Police Department 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 City of Elizabeth. Appendix C contains a complete list of third-party energy suppliers for the City of Elizabeth service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

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

Based on visits from SWA on Tuesday, March 16, 2010 and Wednesday, March 17, 2010 the following data was collected and analyzed.

Building Characteristics

The two-story, (and a partial basement), 82,427 square feet Police Department Headquarters Building was originally constructed in 1987 with additions and alterations completed in 2002. It houses police related offices, a court room, a shooting range, a jail area, mechanics area and locker rooms.

Partial Front Façade (typ.)

Partial Rear Façade (typ.)

Partial Front Façade (typ.)

Partial Left Side Façade (typ.)

Building Occupancy Profiles

Its occupancy is approximately 130 officers and personnel daily at any given time. The building is operated 24 hours per day.

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 exposed CMU (Concrete Masonry Unit) and some stone accents, over concrete block with 3 inches of assumed fiberglass batt cavity insulation. The interior is mostly painted gypsum wallboard or painted CMU..

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall acceptable, age-appropriate condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

The following specific exterior wall problem spot was identified:

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

Roof

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish and reflective stone ballast and coating. It is original and has never been replaced but patched. Roof replacement is being discussed, according to building staff. Three and a half inches of detectable attic/ceiling insulation, and two inches of foam board roof insulation were recorded.

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

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

The following specific roof problem spots were identified:

Signs of standing water/pooling

Rocks/nails or other sharp objects on roof surface

Clogged/damaged roof drains

Base

The building's base is composed of a slab-on-grade floor with a perimeter foundation and no detectable slab edge/perimeter 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 good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains basically two types of windows:

1. Casement and fixed type windows with a non-insulated aluminum frame, clear double glazing and some interior but no exterior shading devices. The windows are located in the original part of the building and have never been replaced.

2. Casement type windows with a vinyl clad and aluminum frame, low-E coated/gas-filled, double glazing. The windows are located in the recent addition and are approximately 8 years old.

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 good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical skylight found

Typical newer window found in recent addition.

Exterior doors

The building contains basically only one type of exterior door:

1. Glass and solid with aluminum/steel frame type exterior doors. They are located throughout the building and are original.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific door problem spots were identified:

Missing/worn weather-stripping

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, 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

Heating is provided by several sources. The majority of the building's heating is provided by twelve (12) 300 MBH 80% efficient, HydroTherm natural gas, hot water boilers, numbered 9-through-20. The unitary boilers were installed in 1986 and feed the baseboard throughout the building, as well as heating coils for each of the 4 main air handlers. In addition the boilers feed even (11) Trane cabinet heaters, and eight (8) Trane unit heaters. Two

alternating pumps and one back up circulate hot water at a rate of 400 GPM. Pump #1 has a 10 HP, 89.5% efficient Baldor motor, and Pump #2 has a 10 HP, 86.5% efficient Marathon Electric motor. Eight other boilers provide domestic hot water. The locker room, lunch room, workshop, storage rooms, and election bureau in the Annex building are heated by a total of ten (10) Chromolox electric baseboards. The garages are heated by a total of eleven (11) Reznor gas-fired unit heaters, ten (10) of which have heating capacities of 105 MBH and one of which has a heating capacity of 30 MBH. All unit heaters are 80% efficient and were installed in 1986. The new narcotics wing is heated by a Trane packaged rooftop DX unit, which provides 205 MBH of gar heat at 81% efficiency. The narcotics office is heated by a smaller Trane packaged rooftop DX unit, which provides 72 MBH of gas heating at 79% efficiency. Both rooftop units were installed in 2003.

Hydrotherm boiler

Cooling

This facility has several cooling systems. The new narcotics wing is cooled by a Trane 10 ton, 10 EER (Energy Efficiency Ratio) packaged rooftop DX unit, and the narcotics office is cooled by a Trane 3 ton, 10 EER packaged rooftop DX unit, both units installed in 2003. Two 110 ton water-cooled Trane chillers, which feed a chilled water loop, are located in the basement. The two chillers are served by a Baltimore Air Coil cooling tower, located on the roof, and three (3) 360 GPM condenser water pumps with 15 HP motors. The phone room in the basement is cooled by a Skil-aire 3-ton split-system air-conditioning system, installed in 1986. Two Trane air-handlers with vortex dampers were installed in the basement in 1996. AC-1 has a 740 MBH cooling coil, a 380 MBH heating coil, a 20 HP Baldor motor, and serves the basement and 1st floor VAV box zoned distribution. AC-2 has a 747 MBH cooling coil, a 373.7 MBH heating coil, a 20 Century motor, and also serves the basement and first floor VAV box zoned distribution. Two more air-handlers are located on the roof that serve the upper floor VAV box zoned distribution systems. AC-1 and AC-2 are each served by ½ HP hot water pumps. AC-3 has a 767 MBH cooling coil, a 399.7 MBH heating coil, and serves the 2nd floor. It is served by a 1 HP hot water pump. AC-4 has a 420 MBH cooling coil, a 216 MBH heating coil, and serves the 2nd floor. It is served by a ¾ HP hot water pump. All four air-handlers are served by three Amtrol chilled water pumps with Marathon Electric motors, numbered 3-through-5. All three pumps are rated at 230 GPM,

and the motors are all rated at 10 HP. Pump #5 serves as a back-up to the other two pumps.

Two (2) Trane chillers (foreground, background)

Ventilation

Ventilation is provided by sixteen (16) exhaust fans, three (3) centrifugal fans, two (2) propeller fans, two (2) roof exhausters, one (1) in-line centrifugal fan, and air-handlers HV-1 and HV-2. HV-1, a Trane unit, provides basement ventilation, and HV-2, a Reznor unit, provides ventilation to the rifle range. All unites were found to be in good operating condition.

Exhaust fan

Domestic Hot Water

Boilers 1-through-8, installed in 1986, provide domestic hot water to the building. The boilers are Hydrotherm 300 MBH and 80% efficient. These units are less efficient then newer units and should be replaced.

Electrical systems

Lighting

A complete inventory of all interior, exterior, and exit sign light fixtures were examined and documented in Appendix B of this report including an estimated total lighting power consumption. The lighting consists primarily of T8 fluorescent fixtures which are energy efficient. The most common fixture is a 100W Mercury lamp in a recessed high hat, T8 fluorescent lamps and electronic ballast. There were also many compact fluorescent fixtures. Due to the 24/7 operation of the Police Department Headquarters and safety concerns, occupancy sensors are not recommended for any area within the building. A detailed list of the recommended upgrades is provided in Appendix B.

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

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. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc.

More information can be found in the “Products” section of the Energy Star website at: http://www.energystar.gov. The building is currently equipped with energy vending miser devices for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Appliances - In this facility, there are one-hundred seventy-six (176) computers, twenty-four (24) radio/cell phone chargers, eleven (11) ceiling fans, nine (9) televisions, seven (7) refrigerators, five (5) copiers, five (5) microwaves, three (3) vending machines, and a Heliofactories Type MA-1 sauna. Most appliances were found to be over the 10 years suggested threshold as noted in the attached equipment list. Each should be considered for the Energy Start Replacement Program.

Process equipment - Two air compressors, a water booster system, and a 200 kW Cummins backup generator are located in the basement.

Elevators

There is one Dover hydraulic elevator in this facility that was found to be well maintained and fully operable.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Police Department 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 Police Department Headquarters is a good candidate for a 135.7 kW Solar Panel installation. See ECM #5 for details.

Solar Thermal Collectors

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

Wind

Wind power production is not appropriate for this location because the available wind energy resource is very low. Also, the positioning of high tension wires and other obstructions would require a wind turbine to be taller than the high tension towers.

Geothermal

The Police Department Headquarters is not a good candidate for geothermal installation since it would require replacement and re-design of the entire existing HVAC system.

Combined Heat and Power

The building 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#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Premium efficiency fan motors and Variable Frequency Drives
2	Lighting Upgrades
3	Install VendingMiser devices
	Description of Recommended 5-10 Year Payback ECMs
4	Building Automation System
5	Install a roof-mounted 135.7 kW Solar PV system
6	Replace gas-fired unit heaters with High Intensity Infrared heaters and install infrared heating override control
	Description of Recommended >10 Year Payback ECMs
7	Pumps with premium efficiency motors
8	High-efficiency boilers with Outdoor Air Reset control
9	High-efficiency chillers

ECM#1: *Premium efficiency fan motors and Variable Frequency Drives*

At the Police Headquarters, there are two 20 HP return air fan motors in the Trane air-handlers, a 10 HP Loren Cook return air fan, and a 7.5 HP Peerless return air fan. All motors are standard-efficiency, and the fans' flow is controlled by inlet guide vanes, which do not work; it is recommended that the motors be replaced with premium-efficiency motors, and that variable-frequency drives (VFDs) be installed to control the fans' flow. VFDs save energy by allowing the volume of the air moving through the fan to match the system demand. The efficiencies of the existing motors, at the time of purchase, were 91% for the Trane air-handler return fans and 84% for the Loren Cook and Peerless fans. Fans with high-efficiency, premium motors are available, which have efficiencies of 93%.

Installation cost:

Estimated installed cost: $13,640 (Includes $3,500 in labor costs)
Source of cost estimate: Contractor

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
1	13,640	311,467	46.7	0	12.9	0	44,851	15	672,769	0.3	4832%	322%	329%	514,127	557,682

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The horsepower ratings of the five motors were converted to kW by multiplying by a factor of 0.746. The fans are estimated to be in operation for the entire year. The power factor for fans with inlet guide vanes, taken from Honeywell's VFD Quick Savings Estimator, is 0.62; due to the face that the flow controls are not working, the power factor is now 1.0. The power factor for units with variable-frequency drives is 0.28. The savings for each motor were calculated using the following equations:

$$\text{Current electric input(kWh)} = \frac{\text{Operating hours} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{HP} \times \text{Power Factor}}{\text{Current efficiency (\%)}}$$

$$\text{Proposed electric input (kWh)} = \frac{\text{Operating hours} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{HP} \times \text{Power Factor}}{\text{Proposed efficiency (\%)}}$$

Savings (kWh)=Current electric input (kWh)-proposed electric input (kWh)

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Premium efficiency 20 HP motors ($113 per motor)*
- *NJ Clean Energy – SmartStart – Premium efficiency 10 HP motors ($90 per motor)*
- *NJ Clean Energy – SmartStart – Premium efficiency 7.5 HP motors ($81 per motor)*
- *NJ Clean Energy – SmartStart – VFD for 20 HP motor ($40 per HP)*
- *NJ Clean Energy – SmartStart – VFD for 10 HP motor ($120 per HP)*
- *NJ Clean Energy – SmartStart – VFD for 7.5 HP motor ($155 per HP)*

Please see Appendix F for more information on Incentive Programs.

ECM#2: *Lighting Upgrades*

Lighting at Elizabeth Police Headquarters primarily consists of energy-efficient fixtures with T8 lamps and electronic ballasts. There are also many compact fluorescent fixtures as well as many incandescent. SWA/BSG-PMK recommends retrofitting the T12 fixtures with T8 lamps and electronic ballasts and the incandescent fixtures with compact fluorescent lamps. In addition, occupancy sensors should be installed to control the lighting in the private offices. Lighting replacements typically yield a short payback and should because of the low cost to upgrade combined favorable energy savings. The labor in all these installations was evaluated using prevailing electrical contractor wages. The City of Elizabeth may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $1,314 (Estimated labor of $250)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

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
2	1,314	7,802	1.2	0	0.3	60	1,183	15	17,752	1.1	1251%	83%	90%	12,612	13,969

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- *NJ Clean Energy – T8 fluorescent fixture ($15 per fixture)*
- *NJ Clean Energy – LED exit signs ($20 per fixture)*

Please see Appendix F for more information on Incentive Programs.

ECM#3: *Install VendingMiser devices*

The average vending machine consumes 4,025 kWh of energy per year, most of which can be attributed to lighting and cooling, which run 24 hours-per-day. Installing occupancy sensors on the building's three vending machines would activate the power to the vending machines when in use, and deactivate the power if the vending machines have not been used for more than 15 minutes. Vending machine lighting would remain off until the adjacent area is occupied again. The refrigeration unit will be shut down for a maximum two hours, in order to maintain a desirable temperature for the product.

Installation cost:

Estimated installed cost: $660 (Estimated labor of $60)
Source of cost estimate: Vendor

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
3	660	3,536	0.7	0	0.1	0	509	10	5,092	1.3	671%	67%	77%	3,639	6,331

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The existing vending machines are currently operated 24/7 or 168 hours per week. SWA assumes that the vending machines would be able to shut down for approximately 68 hours during the week. For complete calculations, please see Appendix H.

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs.

ECM#4: *Install Building Automation System*

The Police Department Headquarters' temperature controls do not have a zoned occupied/unoccupied arrangement. Due to the irregular occupancy of this building, a simplified building automation system (BAS) would provide the ability to monitor and control the building temperature from remote locations. The temperature would be adjusted automatically when the facility is not in use, and save energy by not causing excess heating to be used when the building is unoccupied. The BAS would also control the lighting based on an occupancy schedule. BAS systems save reduce a building's electric and gas consumptions by approximately 15%.

Installation cost:

Estimated installed cost: $110,000 (Estimated labor of $275,000)
Source of cost estimate: Contractor

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
4	350,000	348,795	52.3	9,459	25.9	0	61,284	15	919,261	5.7	163%	11%	15%	371,133	728,784

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Between February 2009 and January 2010, the Police Department Headquarters consumed 63,060 therms of natural gas and 2,325,303 kWh of electricity. BAS systems save reduce a building's electric and gas consumptions by approximately 15%.

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs.

ECM#5: *Install a roof-mounted 135.7 kW roof-mounted Solar PV system*

Currently, the Police Department Headquarters does not use any renewable energy systems. Renewable energy systems, such as photovoltaic panels, can be mounted on the roof of the facility and can offset a significant portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc. being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA/BSG-PMK presents below the economics of installing a 135.7-kW PV system to offset electrical demand for the building and reduce the annual net electric consumption for the building. A system of 590 commercial multi-crystalline 230 watt panels would generate 158,828 kWh of electricity per year, or 6.6% of the Police Department Headquarters annual electric consumption.

Installation cost:

Estimated installed cost: $678,500; (Includes $407,100 in labor)
Source of cost estimate: Similar Projects

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
5	678,500	152,828	22.9	0	6.3	0	113,207	25	2,830,181	6.0	317%	13%	15%	769,469	273,639

*SREC revenue included in "Total 1st Year Savings"

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Cost of installation was estimated using data from similar projects, at approximately $7,000 per kW. Annual energy savings were calculated using PV WATTS, an online tool administered by the National Renewable Energy Laboratory (NREL).

Rebates/financial incentives:

- *NJ Clean Energy – Renewable Energy Incentive Program (REIP) ($1/Watt installed)*

This ECM is eligible for New Jersey's Solar Renewable Energy Certificates (SREC). SRECs are marketable certificates issued to the owner of a PV system for each 1,000 kWh (1MWh) of electricity generated. SRECs are sold or traded separately from the power generated; the income from the sale of the SREC can be used to offset the cost of the system by applying the revenue to a loan payment or debt service. The value of the SREC is market driven, and is controlled by the amount of the Solar Alternative Compliance Payment (SACP) which is set by the NJBPU. The SREC market is derived from New Jersey's Renewable Portfolio Standard (RPS), which requires that all licensed energy suppliers in the state invest in energy generated from renewable sources, with specific requirements for solar power. If a supplier does not invest by purchasing SRECs, the supplier must pay the SACP for a percentage of the total annual power produced. Since SRECs typically trade just below the SACP, there is an incentive for the supplier to buy SRECs. The SREC Program provides a market for SRECs to be created and verified on the owner's behalf. The New Jersey Clean Energy program facilitates the sale of SRECs to New Jersey electric suppliers. PV system owners in New Jersey with a grid-connected PV system are eligible to participate in New Jersey's SREC Program.

The NJBPU has stated its intention to continue to operate a program of rebates and SRECs, On September 12, 2007, the NJBPU approved an SREC only pilot incentive program. The program set the SACP at an initial value of $711, decreasing annually for an eight (8) year period. SRECs would be generated for fifteen (15) years (referred to as the Qualification Life), and have a two (2) year trading life. The NJBPU believes that to achieve an internal rate of return of twelve (12) percent, the target SREC price would be $611, reducing by three (3) percent per year for the same eight (8) year period that the SACP is set.

Please see Appendix F for more information on Incentive Programs.

ECM#6: ***Replace gas-fired unit heaters with High Intensity Infrared heaters and Install infrared heating override control***

Heating is provided to the garages by eleven (11) gas-fired unit heaters, installed in 1986. Nine (9) units have heating capacities of 105 MBH, two (2) have heating capacities of 30 MBH, and all are rated at 80% efficiency. The units have passed the end their 13-year useful life, and should be replaced. High-intensity infrared unit heaters are available, which are 100% efficient. These units differ from unit heaters in that infrared heaters heat the objects beneath them, rather than the air in the space they are serving, which also prevents heat from escaping the building. The current units were 80% efficient at the time of their purchase, but due to their age and condition, their efficiency was estimated to decrease by 10%, to 70%. The heaters operate at all times when the areas are occupied, including when the garage doors are open. The operation of the heaters while the doors are open allows infiltration, and is inefficient as warm air escapes and the heaters need to remain in operation while attempting to maintain the desired temperature. It is recommended that an end switch or photo eye be installed in each of the eight areas that are heated by the unit heaters that will automatically shut off the heaters when the garage doors are in the fully-open position to shut down the heaters.

Installation cost:

Estimated installed cost: $35,500 (Estimated labor of $35,000)
Source of cost estimate: Similar Projects

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
6	35,500	0	0.0	4,335	5.3	0	5,068	15	76,014	7.0	114%	8%	11%	24,131	47,785

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Also taken from the energy bills was the number of heating degree-days for one year, 4,836. Due to the fact that the garages are not occupied at all hours of the day, it was assumed that the units only operate 56 out of a possible 168 hours every week, and therefore only $\frac{56}{168}$ of the heating degree days were used for the calculations of the current energy consumptions; for the proposed energy consumptions, it was assumed that the end switch or photo eye would reduce the weekly operating hours by 15%. Per ASHRAE, the outdoor drybulb temperature is above 10°F 99.6% percent of a year, and the desired indoor temperature was estimated to be 68°F. The savings were calculated using the following equations:

$$\frac{\text{Capacity}\times\text{Degree-Days}\times 24}{\text{Efficiency}_{current}\times\left(\text{Temp.}_{indoor}-\text{Temp.}_{99.6\%}\right)}\times\frac{1\text{ therm}}{100{,}000.4\text{ BTU}}\times\frac{(\text{Weekly Operating Hours})}{24\times 7}=\text{Current Gas Input (therms)}$$

$$\text{Gas Output (therms)}=\text{Current Gas Input}\times\text{Efficiency}_{current}$$

$$\text{Proposed Gas Input (therms)}=\frac{\text{Gas Output}}{\text{Efficiency}_{proposed}}$$

$$\text{Savings (therms)}=\text{Current Gas Input}-\text{Proposed Gas Input}$$

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs.

ECM#7: *Pumps with premium efficiency motors*

There are eight circulation pumps at the Police Headquarters. Pump #1 is a 10 HP hot water circulation pump, Pump#3 and Pump #4 are 10 HP chilled water pumps, and Pump #6 and Pump #7 are 15 HP condenser water pumps. These pumps are recommended for replacement; Pumps #2, #5, and #8 are stand-by pumps, and are not recommended for replacement. The efficiencies of the existing pumps, at the time of purchase, were 89.5% for Pump #1, 86.5% for Pump #3 and Pump #4, and 88.5% for Pump #6 and Pump #7; all efficiencies were estimated to decrease by 3.5% due to re-winding. Pumps with high-efficiency, premium motors are available, which have efficiencies of 94%.

Installation cost:

Estimated installed cost: $16,022 (Estimated labor of $5,500)
Source of cost estimate: Contractor

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	16,022	10,884	1.6	0	0.5	0	1,567	15	23,509	10.2	47%	3%	5%	2,420	19,488

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The horsepower ratings of the five motors were converted to kW by multiplying by a factor of 0.746. In this geographic location, there are 5,954 heating hours (hours in which the outdoor temperature was below 65°F) and 2,806 cooling hours (hours in which the temperature was above 65°F); due to the fact that heating and cooling systems turn on and off, it was assumed that Pump #1 was in operation for half of the heating season, and the other four pumps were in operation for 1/2 of the cooling season. The savings for each pump were calculated using the following equations:

$$\text{Current electric input(kWh)} = \frac{\text{Operating hours} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{HP}}{\text{Current efficiency (\%)}}$$

$$\text{Proposed electric input (kWh)} = \frac{\text{Operating hours} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{HP}}{\text{Proposed efficiency (\%)}}$$

Savings (kWh)=Current electric input (kWh)-proposed electric input (kWh)

Rebates/financial incentives:

- *NJ Office of Clean Energy –Premium efficiency 10 HP motors ($90 per motor)*
- *NJ Office of Clean Energy – Premium efficiency 15 HP motors ($104 per motor)*

Please see Appendix F for more information on Incentive Programs.

ECM#8: *High-efficiency boilers with Outdoor Air Reset control*

Space heating and water heating are provided by twenty (20) 300 MBH HydroTherm, natural gas, hot water boilers, installed in 1987. The units are nearing the end their 25-year useful life, and should be replaced. Higher-efficiency condensing boilers are now available, which are up to 97% efficient. The current unit was 80% efficient at the time of its purchase, but due to its age and condition, its efficiency was estimated to decrease by 10%, to 70%. Rather than twenty boilers, only three (3) 2,000 MBH boilers are recommended. Boilers #1-through-8 solely do water heating, and the new system should include a hot water skid. The new boilers should also be equipped with hot water outdoor air reset control (OAR). These controllers reduce the maximum boiler water temperature depending on the outside air temperature; for instance, if the outside air temperature is 0°F, the boiler temperature will be 180°F, but if the outside air temperature is 40°F, the boiler temperature will only need to be 130°F.Outdoor air reset generally decreases heating costs by 8-15%.

Installation cost:

Estimated installed cost: $334,000 (Estimated labor of $112,000)
Source of cost estimate: Contractor

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
8	334,000	0	0.0	19,216	23.3	300	22,764	25	569,088	14.7	70%	3%	5%	53,694	211,818

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Also taken from the energy bills was the number of heating degree-days for one year, 4,730. It is likely that the areas of this facility only operate part of the week, although the facility as a whole operates constantly, and the facility's annual gas consumption reflects this; therefore, it was estimated that the areas of the building operate for an average of only 56 out of a possible 168 hours every week, and only $\frac{56}{168}$ of the heating degree days were used for these calculations. Per ASHRAE, the outdoor drybulb temperature is above 10°F 99.6% percent of a year, and the desired indoor temperature was estimated to be 68°F. The savings were calculated using the following equations:

$$\frac{\text{Capacity}\times\text{Degree-Days}\times 24}{\text{Efficiency}_{current}\times(\text{Temp.}_{indoor}-\text{Temp.}_{99.6\%})}\times\frac{1\text{ therm}}{100{,}000.4\text{ BTU}}\times\frac{(\text{Weekly Operating Hours})}{24\times 7}=\text{Current Gas Input (therms)}$$

$$\text{Gas Output (therms)}=\text{Current Gas Input}\times\text{Efficiency}_{current}$$

$$\text{Proposed Gas Input (therms)} = \frac{\text{Gas Output}}{\text{Efficiency}_{proposed}}$$

$$\text{Savings (therms)} = \text{Current Gas Input} - \text{Proposed Gas Input}$$

Rebates/financial incentives:

- *NJ Clean Energy – Premium efficiency 2,000 MBH boilers ($1 per MBH)*

Please see Appendix F for more information on Incentive Programs.

ECM#9: *High-efficiency chillers*

Cooling is provided by two 115-ton water-cooled chillers. The units have reached the end of their useful life, and should be replaced with more energy-efficient models. Newer models now use Puron refrigerant, a more efficient fluid than the current R-22 refrigerant. This yields a lower kW/ton (kW of electric usage per ton of cooling) ratio, and a higher Energy Efficiency Ratio (EER). The recommended units are rated at 0.554 kW/ton (equivalent to an EER of 21.7); the current units, due to their age and condition, were estimated to have a rating of 0.95 kW/ton (equivalent to an EER of 12.6).

Installation cost:

Estimated installed cost: $260,900 (Estimated labor of $100,000)
Source of cost estimate: Contractor

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
9	260,900	117,810	17.7	0	4.9	200	17,165	25	429,116	15.2	64%	3%	4%	31,437	210,939

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. EER values, as stated above, are 12.6 for the existing units and 21.7 for the recommended ones. A number of 1,024 cooling degree-days and a 0.4% dry-bulb temperature of 93°F were used for calculations; this data was provided by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). The desired indoor temperature during the cooling season was assumed to be 74°F.

The following equation, the degree-day equation for cooling systems, was used to calculate the electric consumptions of the current and proposed air-conditioners:

$$\frac{\text{Capacity}\times\text{Degree-Days}\times 24\ \frac{\text{hours}}{\text{day}}}{1{,}000\times\text{SEER}\times\left(\text{Temp.}_{0.4\%}-\text{Temp.}_{\text{indoor}}\right)}=\text{Electric Consumption (in kWh)}$$

Rebates/financial incentives:

- *NJ Clean Energy – Premium efficiency water-cooled electric chillers ($170 per ton)*

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 Police Department Headquarters:

- Replace roof and increase level of insulations – SWA observed that the roof is in deteriorating condition and has reached the end of its useful lifetime. The roof was observed to be leaky and allows water to damage interior areas such as walls. Replacing the roof can also provide an opportunity to increase insulation to a minimum value of R-30, which would prevent heat losses through the building envelope as well as provide a steeper drainage plane on the roof to promote water run-off. If the City of Elizabeth decides to install a roof-mounted Solar PV panel system, the roof should be addressed first.

- Purchase Energy Star appliances – Appliances at the Police Department Headquarters were surveyed and many were observed to not be Energy Star rated appliances. All of the appliances were observed to be in good condition and would not be cost-effective to replace at this time. SWA recommends that the building considers purchasing the most energy-efficient equipment when existing equipment fails, 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.

- Replace the Skil-aire split-system AC system – SWA observed that the existing Skil-aire split-system AC has surpassed its useful lifetime. This unit is still functioning and would not be cost-effective to replace at this time. SWA recommends replacing this unit with a high efficiency unit when it fails.

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.

- Caulk unsealed exterior wall penetrations – SWA observed that there were several areas along the exterior façade of the building that contained penetrations for plumbing, electrical, etc. that should be caulked to reduce air infiltration and thermal bridging.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. The roofs also contained many sharp objects that have been tarred over and have become part of the roof. These objects, such as glass and sharp stones, cause holes in the roof surface which allow water to leak in.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. 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.

- 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.

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

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the City of Elizabeth. Based on the requirements of the LGEA program, the City of Elizabeth 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 $2,574.75.

APPENDIX A: EQUIPMENT LIST

Police Department Headquarters Equipment List							
Building System	Description	Locations	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Boiler #9-12: 1,200 MBH (total), 80% efficient	Basement	HydroTherm, M# MR-1200B, S# R-2005-1011	Natural Gas	Entire building	1987	8%
Heating	Boiler #13-16: 1,200 MBH (total), 80% efficient	Basement	HydroTherm, M# MR-1200B, S# R-2005-1010	Natural Gas	Entire building	1987	8%
Heating	Boiler #17-20: 1,200 MBH (total), 80% efficient	Basement	HydroTherm, M# MR-1200B, S# R-2005-1009	Natural Gas	Entire building	1987	8%
Heating	P-1: Heating hot water pump, 400 GPM, 60' head	Basement	Thrush Co., M# 3X9 PF26, S# 97947	Electricity	Main hot water loop	-	-
	Motor: 10 HP, 1,725 RPM, 89.5% efficient		Baldor, Cat. # M3313T, Spec. # 37B101S131H1, S# F0612150320		P-1	-	-
Heating	P-2: Heating stand-by pump, 400 GPM, 60' head	Basement	Amtrol, Inc. Series 2G, M# 3X4X9PF BF, S# 217209 1A	Electricity	Main hot water loop	1986	0%
	Motor: 10 HP, 1,745 RPM, 86.5% efficient		Marathon Electric, M# RVN 215TTDR7026H T L		P-2	-	-
Heating	EH-1: Electric duct heater, 960 CFM, 4 kW	Women's locker room, basement	Indeeco	Electricity	Women's locker room, basement	1986	10%
Heating	EH-2: Electric duct heater, 850 CFM, 4 kW	Men's locker room, basement	Indeeco	Electricity	Men's locker room, basement	1986	10%

Heating	EH-3: Electric duct heater, 1,700 CFM, 7.5 kW	Men's locker room, basement	Indeeco	Electricity	Men's locker room, basement	1986	10%
Heating	EH-4: Electric duct heater, 1,400 CFM, 9 kW	Inmate cells, 1st floor	Indeeco	Electricity	Inmate cells, 1st floor	1986	10%
Heating	GUH-1: Gas-fired unit heater, 30 MBH, 80% efficient	Parts & storage, 1st floor	Reznor, M# XLB-30	Natural Gas	Parts & storage, 1st floor	1986	10%
Heating	GUH-2: Gas-fired unit heater, 105 MBH, 80% efficient	Vehicle repair garage, 1st floor	Reznor, M# XLB-105	Natural Gas	Vehicle repair garage, 1st floor	1986	10%
Heating	GUH-3: Gas-fired unit heater, 105 MBH, 80% efficient	Vehicle repair garage, 1st floor	Reznor, M# XLB-105	Natural Gas	Vehicle repair garage, 1st floor	1986	10%
Heating	GUH-4: Gas-fired unit heater, 105 MBH, 80% efficient	Vehicle repair garage, 1st floor	Reznor, M# XLB-105	Natural Gas	Vehicle repair garage, 1st floor	1986	10%
Heating	GUH-5: Gas-fired unit heater, 105 MBH, 80% efficient	Truck garage, 1st floor	Reznor, M# XLB-105	Natural Gas	Truck garage, 1st floor	1986	10%
Heating	GUH-6: Gas-fired unit heater, 105 MBH, 80% efficient	Truck garage, 1st floor	Reznor, M# XLB-105	Natural Gas	Truck garage, 1st floor	1986	10%
Heating	GUH-7: Gas-fired unit heater, 105 MBH, 80% efficient	Large workshop, 1st floor	Reznor, M# XLB-105	Natural Gas	Large workshop, 1st floor	1986	10%
Heating	GUH-8: Gas-fired unit heater,	Ambulence vehicle garage	Reznor, M# XLB-105	Natural Gas	Ambulence vehicle garage	1986	10%

	105 MBH, 80% efficient						
Heating	GUH-9: Gas-fired unit heater, 30 MBH, 80% efficient	Storage, 2nd floor	Reznor, M# XLB-30	Natural Gas	Storage, 2nd floor	1986	10%
Heating	GUH-10: Gas-fired unit heater, 105 MBH, 80% efficient	Large storage, 2nd floor	Reznor, M# XLB-105	Natural Gas	Large storage, 2nd floor	1986	10%
Heating	GUH-11: Gas-fired unit heater, 105 MBH, 80% efficient	Car wash, 1st floor	Reznor, M# XLB-105	Natural Gas	Car wash, 1st floor	1986	10%
Heating	CH-1: Cabinet heater, 50 MBH, 300 CFM, 1/30 HP	Entrance - End corridor, 1st floor	Trane M# D34A003	Natural Gas, Hot Water	Entrance - End corridor, 1st floor	1986	10%
Heating	CH-2: Cabinet heater, 55 MBH, 550 CFM, 1/20 HP	Vestibule court - Lobby, 1st floor	Trane M# E46A006	Natural Gas, Hot Water	Vestibule court - Lobby, 1st floor	1986	10%
Heating	CH-3: Cabinet heater, 55 MBH, 550 CFM, 1/20 HP	Vestibule - Police lobby, 1st floor	Trane M# E46A006	Natural Gas, Hot Water	Vestibule - Police lobby, 1st floor	1986	10%
Heating	CH-4: Cabinet heater, 60 MBH, 800 CFM, 1/12 HP	Vestibule 113 - 1st floor	Trane M# D34A008	Natural Gas, Hot Water	Vestibule 113 - 1st floor	1986	10%
Heating	CH-5: Cabinet heater, 55 MBH, 550 CFM, 1/20 HP	Lounge 209, 2nd floor	Trane M# E46A006	Natural Gas, Hot Water	Lounge 209, 2nd floor	1986	10%
Heating	CH-6: Cabinet heater	Viewing area, 2nd floor	Trane M# B12E004	Natural Gas, Hot Water	Viewing area, 2nd floor	1986	10%

Heating	CH-7: Cabinet heater, 50 MBH, 300 CFM, 1/30 HP	Vestibule, 1st floor	Trane M# D34A003	Natural Gas, Hot Water	Vestibule, 1st floor	1986	10%
Heating	CH-8: Cabinet heater 200 CFM, 1/60 HP	End corridor adjacent terrace, 2nd floor	Trane M# E46A002	Natural Gas, Hot Water	End corridor adjacent terrace, 2nd floor	1986	10%
Heating	CH-9: Cabinet heater 400 CFM, 1/30 HP	Stair #2, 1st floor	Trane M# B12A004	Natural Gas, Hot Water	Stair #2, 1st floor	1986	10%
Heating	CH-10: Cabinet heater, 25.5 MBH, 400 CFM, 1/30 HP	Lobby, 1st floor - Annex building	Trane M# E46E004	Natural Gas, Hot Water	Lobby, 1st floor - Annex building	1986	10%
Heating	CH-11: Cabinet heater, 12.75 MBH, 200 CFM, 1/60 HP	Stair #8, 1st floor - Annex building	Trane M# B12E002	Natural Gas, Hot Water	Stair #8, 1st floor - Annex building	1986	10%
Heating	UH-1: Unit heater, 200 MBH, 600 CFM, 1/20 HP	Supply storage basement	Trane, M# 40-S	Natural Gas, Hot Water	Supply storage basement	1986	10%
Heating	UH-2: Unit heater, 35 MBH, 800 CFM, 1/20 HP	Property storage basement	Trane, M# 60-S	Natural Gas, Hot Water	Property storage basement	1986	10%
Heating	UH-3: Unit heater, 35 MBH, 800 CFM, 1/20 HP	Property storage basement	Trane, M# 60-S	Natural Gas, Hot Water	Property storage basement	1986	10%
Heating	UH-4: Unit heater, 35 MBH, 800 CFM, 1/20 HP	Duct & pipe space, detention area - 1st floor	Trane, M# 60-S	Natural Gas, Hot Water	Duct & pipe space, detention area - 1st floor	1986	10%
Heating	UH-5: Unit heater, 55 MBH, 1,200 CFM, 1/8 HP	Sallyport, 1st floor	Trane, M# 90-S	Natural Gas, Hot Water	Sallyport, 1st floor	1986	10%

Heating	UH-6: Unit heater, 55 MBH, 1,200 CFM, 1/8 HP	Sallyport, 1st floor	Trane, M# 90-S	Natural Gas, Hot Water	Sallyport, 1st floor	1986	10%
Heating	UH-7: Unit heater, 35 MBH, 800 CFM, 1/20 HP	Duct & pipe space, detention area - 2nd floor	Trane, M# 60-S	Natural Gas, Hot Water	Duct & pipe space, detention area - 2nd floor	1986	10%
Heating	UH-8: Unit heater, 40 MBH, 1,100 CFM, 1/8 HP	B-29	Trane, M# UHSA-070S-8C-AAE, S# D85L02489	Natural Gas, Hot Water	B-29	1986	10%
Heating	EB-1: 4' electric baseboard, 1 kW	Locker room, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Locker room, 1st floor - Annex building	1986	10%
Heating	EB-2: 5' electric baseboard, 1.25 kW	Lunch room, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Lunch room, 1st floor - Annex building	1986	10%
Heating	EB-3: 10' electric baseboard, 2.5 kW	Workshop, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Workshop, 1st floor - Annex building	1986	10%
Heating	EB-4: 4' electric baseboard, 1 kW	Storage, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Storage, 1st floor - Annex building	1986	10%
Heating	EB-5: 6' electric baseboard, 1.5 kW	Elect. Bureau, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Elect. Bureau, 1st floor - Annex building	1986	10%
Heating	EB-6: 10' electric baseboard, 2.5 kW	Ambulance, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Ambulance , 1st floor - Annex building	1986	10%
Heating	EB-7: 3' electric baseboard, 0.375 kW	Storage, 1st floor - Annex building	Chromolox, M# CSH-05A	Electricity	Storage, 1st floor - Annex building	1986	10%
Heating	EB-8: 4' electric baseboard, 1 kW	Storage, 2nd floor - Annex building	Chromolox, M# CSH-05A	Electricity	Storage, 2nd floor - Annex building	1986	10%

Heating	EB-9: 4' electric baseboard, 1 kW	Storage, 2nd floor - Annex building	Chromolox, M# CSH-05A	Electricity	Storage, 2nd floor - Annex building	1986	10%
Heating	EB-10: 4' electric baseboard, 1 kW	Storage, 2nd floor - Annex building	Chromolox, M# CSH-05A	Electricity	Storage, 2nd floor - Annex building	1986	10%
Heating/ Cooling	ACU-1: Rooftop packaged DX unit, 10 tons, 10 EER; 205/203 MBH input/output, 81% efficient	Roof - north end	Trane, M# YCD240B3LCKB, S# 350100744D	Electricity/ Natural Gas	New wing - Narcotics	2003	53%
Heating/ Cooling	ACU-2: Rooftop packaged DX unit, 3 tons, 10 EER; 72/57 MBH input/output, 79% efficient	Roof - north end	Trane, M# YCZ036F3M0BC, S# 3295YF51H	Electricity/ Natural Gas	Narcotics office	2003	53%
Cooling	P-3: Chilled water pump (RFM-1), 230 GPM, 70' head	Basement	Amtrol, Inc. Series 2G	Electricity	AC-1, AC-2, AC-3, AC-4	1986	0%
	Motor: 10 HP, 1,745 RPM, 86.5% efficient		Marathon Electric, M# SVA 215TTDR7026HTL		P-3	-	-
Cooling	P-4: Chilled water pump (RFM-2), 230 GPM	Basement	Amtrol, Inc. Series 2G	Electricity	AC-1, AC-2, AC-3, AC-4	1986	0%
	Motor: 10 HP, 1,745 RPM, 86.5% efficient		Marathon Electric, M# SVA 215TTDR7026HTL		P-4	-	-
Cooling	P-5: Chilled water stand-by pump, 230 GPM, 70' head	Basement	Amtrol, Inc. Series 2G, S# 217209 2A	Electricity	AC-1, AC-2, AC-3, AC-4	1986	0%

	Motor: 10 HP, 1,745 RPM, 86.5% efficient		Marathon Electric, M# SVA 215TTDR7026H T L		P-5	-	-
Cooling	P-6: Condenser water pump (RFM-1), 360 GPM, 70' head	Basement	Amtrol, Inc. Series 2G, M# 3X4X9PF BF, S# 217209 3G	Electricity	Cooling tower	1986	0%
	Motor: 15 HP, 1,740 RPM, 88.5% efficient		Marathon Electric, M# PN 254TTFL5726A N L		P-6	-	-
Cooling	P-7: Condenser water pump (RFM-2), 360 GPM, 70' head	Basement	Amtrol, Inc. Series 2G, M# 3X4X9PF BF, S# 217209 3G	Electricity	Cooling tower	1986	0%
	Motor: 15 HP, 1,740 RPM, 88.5% efficient		Marathon Electric, M# PN 254TTFL5726A N L		P-7	-	-
Cooling	P-8: Condenser water stand-by pump, 360 GPM, 70' head	Basement	Thrush Co., M# 3X9 PF26, S# 97947	Electricity	Cooling tower	-	-
	Motor: 15 HP, 1,760 RPM, 91% efficient		Baldor, Cat. # M2513T, Spec. # 37F599Y723H1, S# F0707160095		P-8	-	-
Cooling	Chiller #1: 50 tons, water-cooled	Basement	Trane, M# CGWCD116RA NKL60GTP, S# L85M33655	Electricity	Chilled water loop	1996	42%
Cooling	Chiller #2: 50 tons, water-cooled	Basement	Trane, M# CGWCD116RA NKL60GTP, S# L85M33656	Electricity	Chilled water loop	1996	42%
Cooling	3-ton split-system air-conditioning system	Basement	Skil-aire, M# PAA036H3A-B, S# K61176	Electricity	Phone room, basement	1986	10%

Cooling	AC-1: Air-handler w/ variable frequency drive & vortex dampers, 740 MBH cooling coil, 380 MBH heating coil	Basement	Trane, M# CCDB35FE0E, S# K86C93578	Electricity	Basement, 1st floor	1996	7%
	Motor: 20 HP, 1,750 RPM, 91% efficient		Baldor, Cat. # M2515T, Spec. # 39D101X113H1, S# Z0408250059	Electricity		2008	87%
Cooling	AC-2: Air-handler w/ variable frequency drive & vortex dampers, 747 MBH cooling coil, 373.7 MBH heating coil	Basement	Trane, M# CCDB35FE0E, S# K86C93579	Electricity	Basement, 1st floor	1996	7%
	Motor: 20 HP, 1,750 RPM, 91% efficient		Century, M# 6-349416-01				
Cooling	AC-3: Air-handler, 767 MBH cooling coil, 399.7 MBH heating coil; 20 HP, 1,750 RPM supply motor; 15 HP, 1,750 RPM return motor	Roof	M# 39ER-36HDT	Electricity	2nd floor	1986	10%
Cooling	AC-4: Air-handler, 420 MBH cooling coil, 216 MBH heating coil; 15 HP, 1,750 RPM supply fan; 7.5 HP, 1,750 RPM return fan	Roof	M# 39ER-19HDT	Electricity	1st floor	1986	10%

Cooling	Hot water pump; 1/2 HP, 1,725 RPM motor	Basement ceiling	Motor: Bell & Gossett, M# AVE 48T17D175A P, Part # 903581	Electricity	AC-1	1986	10%
Cooling	Hot water pump	Basement ceiling	Bell & Gossett 60 Pump, Size # 13T B59, Inent. # 172517, S# 1927237	Electricity	AC-2	1986	10%
	Motor: 1/2 HP, 1,750 RPM, 3 phase		Bell & Gossett, Part # M80037			1986	10%
Cooling	Hot water pump; 1 HP, 1,735 RPM, 78.5% efficient motor	Basement ceiling	Motor: Marathon Electric, M# RN143TTDR7935AD, Part # MBH17	Electricity	AC-3 (roof)	1986	10%
Cooling	Hot water pump; 3/4 HP, 1,725 RPM motor	Basement ceiling	Motor: Marathon Electric, M# 2VM56T17D5530B P, Part # M99073	Electricity	AC-4 (roof)	1986	10%
Cooling	Cooling tower	Roof	Baltimore Aircoil, M# 15146-2, S# 025263601	Electricity	Chiller 1 & 2	2009	95%
Ventilation	EF-1: 1/4 HP, 1,750 RPM, 575 CFM	Roof	Greenheck, M# GB-9-4	Electricity	Restroom exhaust	1986	10%
Ventilation	EF-2: 2 HP, 1,750 RPM, 5,035 CFM	Roof	Greenheck, M# GB-24-20	Electricity	Restroom exhaust	1986	10%
Ventilation	EF-3: 1/3 HP, 1,750 RPM, 1,150 CFM	Roof	Greenheck, M# GB-10-3	Electricity	Restroom exhaust	1986	10%
Ventilation	EF-4: 1/4 HP, 1,750 RPM, 375 CFM	Roof	Greenheck, M# GB-9-4	Electricity	Hood exhaust - ID room	1986	10%
Ventilation	EF-5: 1/2 HP, 1,750 RPM, 2,000 CFM	Roof - Annex building	Greenheck, M# GB-14-5	Electricity	Repair garage ventilation - Annex building	1986	10%
Ventilation	EF-6: 1/4 HP, 1,750 RPM, 1,000 CFM	Roof - Annex building	Greenheck, M# GB-10-4	Electricity	Parts & Storage ventilation - Annex building	1986	10%

Ventilation	EF-7: 1/4 HP, 1,750 RPM, 350 CFM	Roof - Annex building	Greenheck, M# GB-8-4	Electricity	Restroom exhaust - Annex building	1986	10%
Ventilation	EF-8: 1/2 HP, 1,750 RPM, 2,000 CFM	Roof - Annex building	Greenheck, M# GB-14-5	Electricity	Repair garage ventilation - Annex building	1986	10%
Ventilation	EF-9: 3/4 HP. 1,750 RPM, 3,000 CFM	Roof - Annex building	Greenheck, M# GB-18-7	Electricity	Truck garage ventilation - Annex building	1986	10%
Ventilation	EF-10: 3/4 HP, 1,750 RPM, 3,000 CFM	Roof - Annex building	Greenheck, M# GB-18-7	Electricity	Workship ventilation - Annex building	1986	10%
Ventilation	EF-11: 1/4 HP, 1,750 RPM, 1,000 CFM	Roof - Annex building	Greenheck, M# GB-10-4	Electricity	Storage, 2nd floor - Annex building	1986	10%
Ventilation	EF-12: 1/3 HP, 1,750 RPM, 1,000 CFM	Roof - Annex building	Greenheck, M# GB-10-3	Electricity	Ambulence garage exhaust - Annex building	1986	10%
Ventilation	EF-13: 1/4 HP, 1,750 RPM, 125 CFM	Roof - Annex building	Greenheck, M# GB-7-4	Electricity	Restroom exhaust - Annex building	1986	10%
Ventilation	EF-14: 1/4 HP, 1,750 RPM, 650 CFM	Roof	Greenheck, M# GB-10-4	Electricity	Halon exhaust - Front desk room	1986	10%
Ventilation	EF-15: 1/4 HP, 1,750 RPM, 650 CFM	Roof	Greenheck, M# GB-10-4	Electricity	Halon exhaust - Communic ations room	1986	10%
Ventilation	EF-16: 1/4 HP, 1,750 RPM, 300 CFM	Roof	Greenheck, M# GB-8-4	Electricity	Showers & pantry - Detention area	1986	10%
Ventilation	R-1: Centrifugal fan, 10 HP, 1,744 RPM, 17,470 CFM, 84% efficient motor	Basement	Loren Cook; Motor: Siemens-Allis, M# 054, S# 51-391-090	Electricity	AC-1	1986	10%
Ventilation	R-2: Centrifugal fan, 7.5 HP, 1,750 RPM,	Basement	Peerless, M# AF 365 SW	Electricity	AC-2	1986	10%

	13,205 CFM, 84% efficient motor						
Ventilation	E-1: Propeller exhaust fan, 3 HP, 1,750 RPM	Basement	Loren Cook, M# 36A10B, S# B186440-04	Electricity	Mechanical room	1985	10%
Ventilation	E-2: Propeller fan, 2 HP, 1,750 RPM, 2,650 CFM	Refuse room, exterior wall	Peerless, M# PVM-3H	Electricity	Refuse room exhaust	1986	10%
Ventilation	E-3: Roof exhauster fan, 1/2 HP, 1,750 RPM, 1,500 CFM	Roof	Greenheck, M# GPO-14-3	Electricity	Pistol range exhaust	1986	10%
Ventilation	E-4: Roof exhauster fan, 3/4 HP, 1,750 RPM, 2,500 CFM	Roof	Greenheck, M# GPO-18-7	Electricity	Pistol range exhaust	1986	10%
Ventilation	E-5: Centrifugal fan, 1/2 HP, 1,725 RPM, 800 CFM	Vehicular repair garage, 1st floor, Annex building	Engwald, M# EBS-5A	Electricity	Carbon monoxide exhaust, vehicular repair garage, 1st floor, Annex building	1986	10%
Ventilation	E-6: In-line centrifugal fan, 1/3 HP, 1,725 RPM, 1,700 CFM	Emergency generator room	Greenheck, M# SQD-14-3; motor: Marathon Electric, M# RVC48S17D2056E	Electricity	Electrical room & communications room, basement	1986	10%
Ventilation	HV-1: Air-handler, 654 MBH heating coil Motor: 5 HP, 1,740 RPM, 85.5% efficiency	Basement	Trane, M# CCDB17AN0E, S# K86C93580 Marathon Electric, M# SVA 184TDR7627ACL	Electricity	Basement ventilation	1996	7%
Ventilation	HV-2: Air-handler	Roof	Reznor	Electricity	Rifle Range		0%
Ventilation	Pump	Mechanical room	Armstrong, M# 816032-000, S# 0209	Electricity	HV-1	1986	10%

	Motor, 3/4 HP, 1,735 RPM, 3 phase		Marathon Electric, M# WVN56T17D5540B, Part # 131012-083			1986	10%
DHW	Boiler #1-4: 1,200 MBH (total), 80% efficient	Basement	HydroTherm, M# MR-1200B, S# R-2005-1013	Natural Gas	Entire building	1987	8%
DHW	Boiler #5-8: 1,200 MBH (total), 80% efficient	Basement	HydroTherm, M# MR-1200B, S# R-2005-1012	Natural Gas	Entire building	1987	8%
Appliances	Microwave	Basement	Samsung, M# MO1650BA, S# 71CRB00205J	Electricity	Basement	2001	50%
Appliances	Refrigerator	Basement	GE, M# TB12SCB, S# VM 526119	Electricity	Basement	1991	0%
Compressed Air	Air Compressor #1	Basement	Air Compressor Products, M# ACP-C6SA-512H3, S# 1086-1-7352	Electricity	Controls throughout	-	70%
	Air compressor motor, 5 HP, 1,725 RPM, 81% efficient		Baldor, M# M3218T, S# 56B01Y46	Electricity	Air Compressor #1	-	
Compressed Air	Air Compressor #2	Basement	Air Compressor Products, M# ACP-C6SA-512H3, S# 1086-1-7353	Electricity	Controls throughout	-	70%
	Air compressor motor, 5 HP, 1,725 RPM, 81.5% efficient		Baldor, M# M5218T, S# 36B01Y46	Electricity	Air Compressor #2	-	
Water Booster System	Water booster system w/ a 5 HP, 3,490 RPM, 82.5% efficient pump	Basement	Motor: WEG, M# 00536ES3E184JM, S# 1001628110	Electricity	Domestic water system	2009	93%
Backup Power	Backup AC generator, 200 kW, 1,800 RPM	B-29	Cummins, M# 500FDR7137JJW, S# SD 19-52174-4/28	Oil	Entire building	-	-

Elevator	Elevator #1 (main)	Lobby	Liberty elevator, M# 279-1390	Electricity	Lobby	1986	20%

Note: The remaining useful life of a system (in %) is the relationship between the system manufactured and/or installed date and the standard life expectancy of similar equipment based on ASHRAE (2003), ASHRAE Handbook: HVAC Applications, Chapter 36.

Appendix B: Lighting Study

LIGHTING ANALYSIS

Township of Elizabeth
Police Department
1 Police plaza

BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

Upgrade Code	Upgrade Description	Existing		Proposed		Lighting		
		Fixture	Watts	Fixture	Watts	Total # of Upgrades	Cost per Upgrade ($)	SmartStart Rebate per Upgrade
1	2x2 T8 fixture with 2 Utube lamps	2L22"	62	No Upgrade	62	397	$0.00	$0.00
2	4' Fixture with 1T8 Lamp	1L4' T8/ELEC	31	No Upgrade	31	150	$0.00	$0.00
3	3' Fixture with 1 T8 Lamp	(1) FO25T8/ELEC	30	No Upgrade	30	45	$0.00	$0.00
4	2' Fixture with 1 T8 Lamp	(1) FO17T8/ELEC	18	No Upgrade	18	1	$0.00	$0.00
5	4' T12 fixture with 2 energy saver lamps	2L4' EE/STD	80	2L4' T8/ELEC	61	12	$50.00	$15.00
6	Mercury Lamp 1 bulb 100w recessed High Hat	100W MV/BALLAST	120	No Upgrade	120	186	$0.00	$0.00
7	4' T12 fixture with 1 energy saver lamps	1L4' EE/STD	50	1L4' T8/ELEC	31	20	$40.00	$15.00
8	CFL-17W	17W CF/SI INT	17	No Upgrade	17	1	$0.00	$0.00
9	Ceiling Mounted 2 Lamp 32 W T8	2L4' T8/ELEC	61	No Upgrade	61	15	$0.00	$0.00
10	Wallpacks surface mounted 2 lamp 32T8	2L4' T8/ELEC	61	No Upgrade	61	32	$0.00	$0.00
11	Recessed High Hat 1 lamp 60 W w/ recflectors	60W INCANDESCENT	60	15W CF/SI	15	54	$6.00	$0.00
12	Halogen 60W Dimmer switch recessed	60W HALOGEN	60	26W CF/SI	28	10	$10.00	$0.00
13	4' Fixture with 4 T8 Lamps	4L4' T8/ELEC	110	No Upgrade	110	1	$0.00	$0.00
14	4' Fixture with 2 T8 Lamps	2L4' T8/ELEC	61	No Upgrade	61	52	$0.00	$0.00
15	2 2prong CFL 26W- Recessed	26W CF/HW	28	No Upgrade	28	14	$0.00	$0.00
16	High Bay Metal Halide 250W	250W MH/BALLAST	286	No Upgrade	286	47	$0.00	$0.00
17	Recessed 3 lamp 32 W t8	3L4' T8/ELEC	89	No Upgrade	89	3	$0.00	$0.00
18	Wrap around surface mount 4 lamp 32 W T8	4L4' T8/ELEC	110	No Upgrade	110	16	$0.00	$0.00
19	75W Incandescent Flood lamp	75W Incandescent	75	26W CF/SI	28	30	$10.00	$0.00
20	Circular Compact Fluorescent	1L8" (DIA) EE/ELEC	22	No Upgrade	22	4	$0.00	$0.00
21	7W Compact Fluorescent	7W CF/SI	10	No Upgrade	10	7	$0.00	$0.00
22	LED Exit Sign	LED	2	No Upgrade	2	5	$0.00	$0.00
23	Incandescent Exit Sign	15W EXIT	15	LED	2	23	$40.00	$0.00
24	1 Lamp 4' T12 Fixture	1L4' EE/STD	50	1L4' T8/ELEC	31	25	$40.00	$15.00

Summary	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$1,814.00	$0.00	$1,814.00
Rebate	$500.00	$0.00	$500.00
Net Cost	$1,314.00	$0.00	**$1,314.00**
Savings (kWh)	7,802	0	**7,802**
Savings ($)	$1,092.31	$0.00	**$1,092.31**
Payback	1.2		**1.2**

Variables:

$0.14	Avg. Electric Rate ($/kWh)
	Avg. Demand Rate ($/kW)
8760	Operating Hours/Year
24	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

													Lighting						Occupancy Sensors (ONLY)						Lighting & Occupancy Sensors			
Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Existing				Proposed			kW Reduction	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Controls		Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	SmartStart Rebate		Energy Savings, kWh	Post-Rebate Cost ($)	Savings ($)	Payback (yrs)
					Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts						Type	Qty.					Lighting	Sensors				
		Totals:					78019				75347	2,672	7802	$1,814.00	$1,092.31	1.7			0	$0.00	$0.00		$500.00	$0.00	7802	$1,314.00	$1,092.31	1.2
1	5	**Basement**	8	2920	2L4' EE/STD	12	960		2L4' T8/ELEC	12	732	0.228	666	$600.00	$93.21	6.4			0	$0.00	$0.00		$180.00	$0.00	666	$420.00	$93.21	4.5
2	2	Boiler room	8	2920	1L4' T8/ELEC	17	527		No Upgrade	17	527	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
3	1	Network room	8	2920	2L22'	9	558		No Upgrade	9	558	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
4	2	Server room	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
5	2	Elevator room	8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
6	1	Locker room	8	2920	2L22'	21	1302		No Upgrade	21	1302	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
7	1	Bathroom	8	2920	2L22'	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
8	8	Showers	8	2920	17W CF/SI INT	1	15		No Upgrade	1	15	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
9	11		8	2920	60W INCANDESC	2	60		17W CF/SI INT	2	15	0.045	131	$8.00	$18.40	0.3			0	$0.00	$0.00		$0.00	$0.00	131	$8.00	$18.40	0.3
10	3	Bathroom	8	2920	(1) FO25T8/ELEC	1	30		No Upgrade	1	30	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
11	3	Fax	8	2920	(1) FO25T8/ELEC	1	30		No Upgrade	1	30	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
12	1	Office	8	2920	2L22'	10	620		No Upgrade	10	620	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
13	19		8	2920	75W Incandescen	10	75		26W CF/SI	10	26	0.047	137	$8.00	$19.21	0.3			0	$0.00	$0.00		$0.00	$0.00	137	$8.00	$19.21	0.3
14	1	Hallway	8	2920	2L22'	9	558		No Upgrade	9	558	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
15		B12 (lockout)	8	2920		0													0	$0.00	$0.00			$0.00				
16	11	Punch clock room	8	2920	60W INCANDESC	1	60		17W CF/SI INT	1	15	0.045	131	$8.00	$18.40	0.3			0	$0.00	$0.00		$0.00	$0.00	131	$8.00	$18.40	0.3
17	6	Break area	8	2920	100W MV/BALLA	12	1440		No Upgrade	12	1440	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
18	1	Gym/weight room	8	2920	2L22'	22	1364		No Upgrade	22	1364	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
19	2	Sauna	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
20	1	Foyer	8	2920	2L22'	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
21	1	Women's locker	0	2920	2L22'	7	434		No Upgrade	7	434	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
22	2	Maintenance office	8	2920	1L4' T8/ELEC	4	124		No Upgrade	4	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
23	1	Emergency Service Unit	0	2920	2L22'	4	240		No Upgrade	4	240	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
24	2	Prep room	8	2920	1L4' T8/EL EC	11	341		No Upgrade	11	341	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
25	6	Elavator Foyer	8	2920	100W MV/BALLA	4	480		No Upgrade	4	480	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
26	20	Stairs	8	2920	1L8' (DIA) FF/EL	4	32		No Upgrade	4	32	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
27	3	Elevator	8	2920	(1) FO25T8/ELEC	3	90		No Upgrade	3	90	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
28	6	Hallway	8	2920	100W MV/BALLA	50	6000		No Upgrade	50	6000	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
29	19	Telephone bank	8	2920	75W Incandescen	5	75		26W CF/SI	5	26	0.047	137	$8.00	$19.21	0.3			0	$0.00	$0.00		$0.00	$0.00	137	$8.00	$19.21	0.3
30	7	Lobby	8	2920	1L4' EE/STD	20	1000		1L4' T8/ELEC	20	620	0.36	1110	$800.00	$155.34	5.1			0	$0.00	$0.00		$300.00	$0.00	1110	$500.00	$155.34	3.2
31	21	Display Case	8	2920	7W CF/SI	7	70		No Upgrade	7	70	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
32	11		8	2920	60W INCANDESC	2	10		No Upgrade	7	10	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
33		**1st Floor**																	0	$0.00	$0.00			$0.00				
34	11	Juvenile holding cell	8	2920	60W INCANDESC	6	60		17W CF/SI INT	6	15	0.045	131	$8.00	$18.40	0.3			0	$0.00	$0.00		$0.00	$0.00	131	$8.00	$18.40	0.3
35	1	Front desk	8	2920	2L22'	6	372		No Upgrade	6	372	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
36	2	Bathroom	8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
37	22	LED Exit signs	8	2920	LED	5	2		No Upgrade	5	2	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
38	2	Elevator room	8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
39	2	Hallway/front desk	8	2920	1L4' T8/ELEC	3	93		No Upgrade	3	93	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
40	2	Holding cells	8	2920	1L4' T8/ELEC	6	186		No Upgrade	6	186	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
41	2	Fingerprinting/Booking	8	2920	1L4' T8/ELEC	4	124		No Upgrade	4	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
42	2		8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
43	2	Holding area 1	8	2920	1L4' T8/ELEC	3	93		No Upgrade	3	93	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
44	2	Holding area 2	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
45	2	CR COR	8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
46	9	Jail	0	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
47	9		8	2920	2L4' T8/ELEC	11	671		No Upgrade	11	671	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
48	10	Stairway	0	2920	2L4' T8/ELEC	16	976		No Upgrade	16	976	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
49	6	Foyer	8	2920	100W MV/BALLA	0	0		No Upgrade										0	$0.00	$0.00			$0.00				

50	6	Classroom	8	2920	100W MV/BALLA	23	2760		No Upgrade	23	2760	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
51	1	Hallway	8	2920	2L22'	6	372		No Upgrade	6	372	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
52	1	Patrol officers	8	2920	2L22'	6	372		No Upgrade	6	372	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
53	1	Parol admin office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
54	1	Closet	8	2920	2L22'	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
55	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
56	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
57	1	Office	8	2920	2L22'	6	372		No Upgrade	6	372	0	0	$0.00	$0.00				0		$0.00		$0.00	$0.00	0		$0.00	
58	1	Traffic division	8	2920	2L22'	7	434		No Upgrade	7	434	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
59	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
60	1	Office	8	2920	2L22'	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
61	1	Cost	8	2920	2L22'	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
62	1	Men's room	8	2920	2L22'	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
63	2		8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
64	1	Women's room	8	2920	2L22'	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
65	2		8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
66	1	E/P	8	2920	2L22'	9	558		No Upgrade	9	558	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
67	10		8	2920	2L4' T8/ELEC	1	61		No Upgrade	1	61	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
68	2	Elevator 2	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
69	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
70	2	Evidence Storage Room	8	2920	1L4' T8/ELEC	62	1922		No Upgrade	62	1922	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
71	2	Vault	8	2920	1L4' T8/ELEC	9	279		No Upgrade	9	279	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
72	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
73	1	Office Area	8	2920	2L22'	20	1240		No Upgrade	20	1240	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
74	6		8	2920	100W MV/BALLA	6	720		No Upgrade	6	720	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
75	23	Exit incandescents	8	2920		12	15		LED	12	2	0.013	38	$40.00	$5.31	7.5			0	$0.00	$0.00		$10.00	$0.00	38	$30.00	$5.31	5.6
76	1	File room	8	2920	2L22'	20	1240		No Upgrade	20	1240	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
77	19		8	2920	75W Incandescen	9	75		26W CF/SI	9	28	0.047	137	$6.00	$19.21	0.3			0	$0.00	$0.00		$0.00	$0.00	137	$6.00	$19.21	0.3
78	1	Office	8	2920	2L22'	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
79	19	Desk	8	2920	75W Incandescen	6	75		26W CF/SI	6	28	0.047	137	$6.00	$19.21	0.3			0	$0.00	$0.00		$0.00	$0.00	137	$6.00	$19.21	0.3
80	1	Photolab	8	2920	2L22'	9	558		No Upgrade	9	558	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
81	10	Stairwell	8	2920	2L4' T8/ELEC	5	305		No Upgrade	5	305	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
82	10	Closet/stairwell	8	2920	2L4' T8/ELEC	4	244		No Upgrade	4	244	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
83	6	Court foyer	8	2920	100W MV/BALLA	7	840		No Upgrade	7	840	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
84	16		8	2920	250W MH/BALLA	6	286		No Upgrade	6	286	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
85	11	Court room	8	2920	60W INCANDESC	21	1260		15W CF/SI	21	315	0.945	2759	$126.00	$386.32	0.3			0	$0.00	$0.00		$0.00	$0.00	2759	$126.00	$386.32	0.3
86	11	Track Lighting	8	2920	60W INCANDESC	8	480		15W CF/SI	8	120	0.36	1051	$48.00	$147.17	0.3			0	$0.00	$0.00		$0.00	$0.00	1051	$48.00	$147.17	0.3
87	3		8	2920	(1) FO25T8/ELEC	3	240		No Upgrade	3	240	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
88	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
89	1	File room	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
90	1	Hallway	8	2920	2L22'	8	496		No Upgrade	8	496	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
91	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
92	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
93	11	Bathroom	8	2920	60W INCANDESC	1	60		15W CF/SI	1	15	0.045	131	$6.00	$18.40	0.3			0	$0.00	$0.00		$0.00	$0.00	131	$6.00	$18.40	0.3
94	1	Office	8	2920	2L22'	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
95	1	Violations Area	8	2920	2L22'	3	186		No Upgrade	3	186	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
96	1	Copy room	8	2920	2L22'	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	

					Existing				Proposed				Lighting						Occupancy Sensors (ONLY)						Lighting & Occupancy Sensors			
Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts	kW Reduction	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Controls Type	Controls Qty.	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	SmartStart Rebate Lighting	SmartStart Rebate Sensors	Energy Savings, kWh	Post-Rebate Cost ($)	Savings ($)	Payback (yrs)
97	1	Violations Area	8	2920	2L22"	15	930		No Upgrade	15	930	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
98	1	Violations Area	8	2920	2L22"	6	372		No Upgrade	6	372	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
99	1	Foyer	8	2920	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
100	1	Office	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
101		**2nd Floor**																	0	$0.00	$0.00			$0.00				
102	11	Track Lighting	8	2920	60W INCANDESC	8	60		17W CF/SI INT	8	15	0.045	131	$6.00	$18.40	0.3			0	$0.00	$0.00		$0.00	$0.00	131	$6.00	$18.40	0.3
103	6	Foyer	8	2920	100W MV/BALLA	24	2880		No Upgrade	24	2880	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
104	1	Break room	8	2920	2L22"	7	434		No Upgrade	7	434	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
105	1	Director of Police Secretary	8	2920	2L22"	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
106	12	Conference room	8	2920	60W HALOGEN	8	480		28W CF/SI	8	224	0.256	748	$80.00	$104.65	0.8			0	$0.00	$0.00		$0.00	$0.00	748	$80.00	$104.65	0.8
107	1	Office	8	2920	2L22"	9	558		No Upgrade	9	558	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
108	1	Office	8	2920	2L22"	8	496		No Upgrade	8	496	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
109	12	Office	8	2920	60W HALOGEN	1	60		26W CF/SI	1	28	0.032	93	$10.00	$13.08	0.8			0	$0.00	$0.00		$0.00	$0.00	93	$10.00	$13.08	0.8
110	12	Office	8	2920	60W HALOGEN	1	60		26W CF/SI	1	28	0.032	93	$10.00	$13.08	0.8			0	$0.00	$0.00		$0.00	$0.00	93	$10.00	$13.08	0.8
111	1	Office	8	2920	2L22"	8	496		No Upgrade	8	496	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
112	6	Detective bureau	8	2920	100W MV/BALLA	10	1200		No Upgrade	10	1200	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
113	1		8	2920	2L22"	47	2914		No Upgrade	47	2914	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
114	1	Closet	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
115	1	Break room	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
116	9	Blood drying	8	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
117	2	Interrogation 1	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
118	2	Interrogation 2	8	2920	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
119	2	Closet	8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
120	1	Men's room	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
121	10		8	2920	2L4' T8/ELEC	1	61		No Upgrade	1	61	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
122	1	Women's room	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
123	10		8	2920	2L4' T8/ELEC	1	61		No Upgrade	1	61	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
124	1	Office	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
125	1	Office	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
126	1	(2) Bathrooms	8	2920	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
127	2		8	2920	1L4' T8/ELEC	1	31		No Upgrade	1	31	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
128	1	Service/Electrical Closets	8	2920	2L22"	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
129	1	Office area	8	2920	2L22"	18	1116		No Upgrade	18	1116	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	

130	6	Office	8	2920	100W MV/BALLAS	3	360		No Upgrade	3	360	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
131	13		8	2920	4L4' T8/ELEC	1	110		No Upgrade	1	110	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
132	3	911/Office area	8	2920	(1) FO25T8/ELEC	32	960		No Upgrade	32	960	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
133	14	Hallway	8	2920	2L4' T8/ELEC	3	183		No Upgrade	3	183	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
134	14	Office	8	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
135	14	Office	8	2920	2L4' T8/ELEC	3	183		No Upgrade	3	183	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
136	14	Office area	8	2920	2L4' T8/ELEC	22	1342		No Upgrade	22	1342	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
137	14	Cell	8	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
138	14	Cell	8	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
139	14	Office	8	2920	2L4' T8/ELEC	4	244		No Upgrade	4	244	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
140	14	Office	8	2920	2L4' T8/ELEC	6	366		No Upgrade	6	366	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
141	6	Stairwell	8	2920	100W MV/BALLAS	3	360		No Upgrade	3	360	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
142	14	Hallway	8	2920	2L4' T8/ELEC	3	183		No Upgrade	3	183	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
143	15	Bathroom	8	2920	26W CF/HW	7	196		No Upgrade	7	196	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
144	15	Bathroom	8	2920	26W CF/HW	7	196		No Upgrade	7	196	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
145	14	Server room	8	2920	2L4' T8/ELEC	2	122		No Upgrade	2	122	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
146	14	Hallway	8	2920	2L4' T8/ELEC	3	183		No Upgrade	3	183	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
147		Firing range (locked)																	0	$0.00	$0.00			$0.00						
148	10	Stairwell	8	2920	2L4' T8/ELEC	4	244		No Upgrade	4	244	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
149	23	Exit inc.	8	2920		11	15		LED	11	2	0.013	38	$40.00	$5.31	7.5			0	$0.00	$0.00		$10.00	$0.00	38	$30.00	$5.31	5.6		
150	6	Under Hang	8	2920	100W MV/BALLAS	35	4200		No Upgrade	35	4200	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
151	16		8	2920	250W MH/BALLAS	3	286		No Upgrade	3	286	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
152	16	Garage bay	8	2920	250W MH/BALLAS	18	5148		No Upgrade	18	5148	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
153	1	Garage office	8	2920	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
154	17	Office	8	2920	3L4' T8/ELEC	3	267		No Upgrade	3	267	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
155	1	Locker Room/ Showers	8	2920	2L22"	3	186		No Upgrade	3	186	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
156	1	Locker Storage	8	2920	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
157	2	Oil room/storage room	8	2920	1L4' T8/ELEC	9	279		No Upgrade	9	279	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
158	16	Motorcycle storage	8	2920	250W MH/BALLAS	9	2574		No Upgrade	9	2574	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
159	18		8	2920	4L4' T8/ELEC	10	1100		No Upgrade	10	1100	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
160	16	Storage Garage	8	2920	250W MH/BALLAS	7	2002		No Upgrade	7	2002	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
161	18		8	2920	4L4' T8/ELEC	6	660		No Upgrade	6	660	0		$0.00									$0.00	$0.00						
162	1	Traffic office	8	2920	2L22"	6	372		No Upgrade	6	372	0		$0.00									$0.00	$0.00						
163	1	Office	8	2920	2L22"	5	310		No Upgrade	5	310	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
164	6	Foyer	8	2920	100W MV/BALLAS	5	600		No Upgrade	5	600	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
165	1	DARE office	8	2920	2L22"	3	186		No Upgrade	3	186	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
166	1	Hallway	8	2920	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
167	16	DARE office	8	2920	250W MH/BALLAS	4	1144		No Upgrade	4	1144	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
168	4	Bathroom	8	2920	(1) FO17T8/ELEC	1	18		No Upgrade	1	18	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
169		**Exterior**																	0	$0.00	$0.00			$0.00						
170	6		8	2920	100W MV/BALLAS	4	480		No Upgrade	4	480	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00			
171	24		8	2920		25				25									0	$0.00	$0.00			$0.00						

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

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 Elizabethtown Gas Co. Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com

South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX 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.

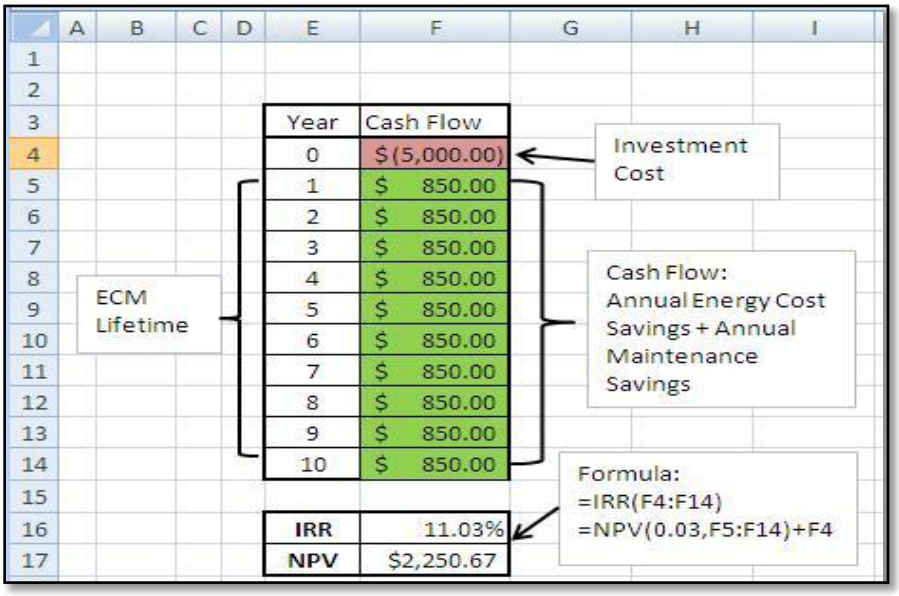
Calculation References

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 Elizabeth - Police Department Headquarters

Building ID: 2250742
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: June 14, 2010

Facility
City of Elizabeth - Police Department Headquarters
1 Police Plaza
Elizabeth, NJ 07201

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1992
Gross Floor Area (ft²): 82,427

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	7,044,087
Natural Gas (kBtu)[4]	5,741,125
Total Energy (kBtu)	12,785,212

Energy Intensity[5]

Site (kBtu/ft²/yr)	155
Source (kBtu/ft²/yr)	358

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,378

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	128%
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.

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

Certifying Professional
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, normalized to a 12-month period.
4. Natural Gas values in therms or cubic feet are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, normalized 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 80%** 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/.

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

APPENDIX G: ENERGY CONSERVATION MEASURES

Energy Conservation Measures																			
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	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
1	Premium efficiency fan motors and Variable Frequency Drives	Contractor	19,000	5,360	13,640	311,467	46.7	0	12.9	0	44,851	15	672,769	0.3	4832%	322%	329%	514,127	557,682
2	Lighting Upgrades	RS Means	1,814	500	1,314	7,802	1.2	0	0.3	60	1,183	15	17,752	1.1	1251%	83%	90%	12,612	13,969
3	Install VendingMiser devices	Vendor	660	0	660	3,536	0.7	0	0.1	0	509	10	5,092	1.3	671%	67%	77%	3,639	6,331
4	Building Automation System	Contractor	350,000	0	350,000	348,795	52.3	9,459	25.9	0	61,284	15	919,261	5.7	163%	11%	15%	371,133	728,784
5	Install a roof-mounted 135.7 kW Solar PV system	Similar Projects	814,200	135,700	678,500	152,828	22.9	0	6.3	0	113,207	25	2,830,181	6.0	317%	13%	15%	769,469	273,639
6	Replace gas-fired unit heaters with High Intensity Infrared heaters and Install infrared heating override contro	Similar Projects	35,500	0	35,500	0	0.0	4,335	5.3	0	5,068	15	76,014	7.0	114%	8%	11%	24,131	47,785
7	Pumps with premium efficiency motors	Contractor	16,500	478	16,022	10,884	1.6	0	0.5	0	1,567	15	23,509	10.2	47%	3%	5%	2,420	19,488
8	High-efficiency boilers with Outdoor Air Reset control	Contractor	340,000	6,000	334,000	0	0.0	19,216	23.3	300	22,764	25	569,088	14.7	70%	3%	5%	53,694	211,818
9	High-efficiency chillers	Contractor	300,000	39,100	260,900	117,810	17.7	0	4.9	200	17,165	25	429,116	15.2	64%	3%	4%	31,437	210,939
	TOTALS		**1,877,674**	**187,138**	**1,690,536**	**953,122**	**143.1**	**33,010**	**79.5**	**560**	**267,598**	-	**5,542,782**	**6.3**	-	-	-	**1,782,663**	**2,070,434**

APPENDIX H: VENDINGMISER CALCULATIONS

EnergyMisers

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

Savings Calculator

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

Energy Costs ($0.000 per kWh)	.144
Facility Occupied Hours per Week	100
Number of Cold Drink Vending Machines	3
Number of Non-refrigerated Snack Machines	0
Power Requirements of Cold Drink Machine (Watts; 400 typical)	400
Power Requirements of Snack Machine (Watts; 80 typical)	80
VendingMiser® Sale Price (for cold drink machines)	$220.00
SnackMiser™ Sale Price (for snack machines)	$79.00

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	10483	6947	3536	34%
Cost of Operation	$1,509.58	$1,000.40	$509.18	34%

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	10483	6947	3536	34%
Cost of Operation	$1,509.58	$1,000.40	$509.18	34%

Total Project Cost	Break Even (Months)
$660	15.55

Estimated Five Year Savings on ALL Machines = $2,545.92

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions, eQUEST
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.