Steven Winter Associates, Inc.
Building Systems Consultants
www.swinter.com

293 Route 18, Suite 330
East Brunswick, NJ 08816

Telephone (866) 676-1972
Facsimile (203) 852-0741

June 28, 2010

Local Government Energy Program
Energy Audit Final Report

Borough of Chatham
Fire Department
1 Fire House Plaza
Chatham, NJ 07928

Project Number: LGEA64

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EXECUTIVE SUMMARY

The Borough of Chatham Fire Department is a two-story building comprising a total conditioned floor area of 10,100 square feet. The original structure was built in 1959, with a partial second floor added in 1998. The following chart provides an overview of current energy usage in the Borough Fire Department based on the analysis period of February 2009 through January 2010:

Table 1: State of Borough Fire Department—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage, gal/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	68,120	6,067	N/A	18,806	80.0	839
Proposed	31,470	4,697	N/A	10,797	54.1	577
Savings	36,650	1,370	N/A	8,009	25.9	262
% Savings	54%	23%	N/A	43%	32%	31%

There may be energy procurement opportunities for the Borough of Chatham Fire Department to reduce annual electric utility costs, which are $1,845 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Borough Fire Department in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This Fire Station/Police Station facility is comprised of non-eligible ("Other") space type. The resulting usage is 80.0 kBtu/sq ft yr, which is slightly lower than the comparable national average by 2.6%.

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	2,623	1.0	2,696	12,958
5-10 Year	16,940	9.3	157,715	37,186
>10 year	2,177	16.7	36,282	21,782
Total	21,740	9.0	196,693	71,926

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 6 cars from the roads each year or avoiding the need of 175 trees to absorb the annual CO_2 generated.

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

Further Recommendations:

SWA recommends that the Borough Fire Department further explore the following:

- Capital Improvements
    - Install NEMA Premium motors when replacements are required
    - Replace roof finish due to age and condition
    - Replace windows installed over 15 years ago with a low-E, double glazed type
    - Add insulation to second floor ceiling
    - Replace heating terminal units - such as perimeter baseboard radiators
    - Replace toilet exhaust fans and ductwork serving the second floor
    - Install CO detectors/alarms in the engine bays and nearby spaces

- Operations and Maintenance
    - Overgrown ground vegetation should be trimmed/removed to not touch or block wall
    - Maintain weather-stripping around all exterior doors and roof hatches
    - Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
    - Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing
    - Provide weather-stripping/air-sealing
    - Repair/seal wall cracks and penetrations
    - Provide water-efficient fixtures and controls
    - Purchase ENERGY STAR® labeled appliances, when equipment is installed or replaced
    - Use smart power electric strips
    - Create an energy educational program
    - Water levels in the expansion tanks and the integrity of the tank bladders should be checked
    - Tighten belts on exhaust fans - tightening belts on exhaust fans can maximize efficiency
    - Change filters in rooftop units and HEPA filter units monthly to ensure efficient operation
    - Insulate heating hot water and DHW piping in the Boiler room and throughout the building

Financial Incentives and Other Program Opportunities

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

SWA recommends that the Borough of Chatham implement the ECMs as listed in increasing order of simple payback with measures consisting of lighting (apply for Direct Install option), programmable thermostats, new refrigerators/freezers, a Solar PV installation, boiler and DHW heater upgraded to highly efficient condensing type units and high efficiency rooftop condensers. The building size does not lend itself to a full P4P process application.

INTRODUCTION

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

Steven Winter Associates, Inc. (SWA) is a 38-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, whole building strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Borough Fire Department at 1 Fire House Plaza Chatham, NJ 07928 The process of the audit included facility visits on April 7, 12 and 22, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current Borough Fire Department conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current Borough Fire Department systems along with a detailed inventory of Borough Fire Department 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 Borough of Chatham to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Borough Fire Department.

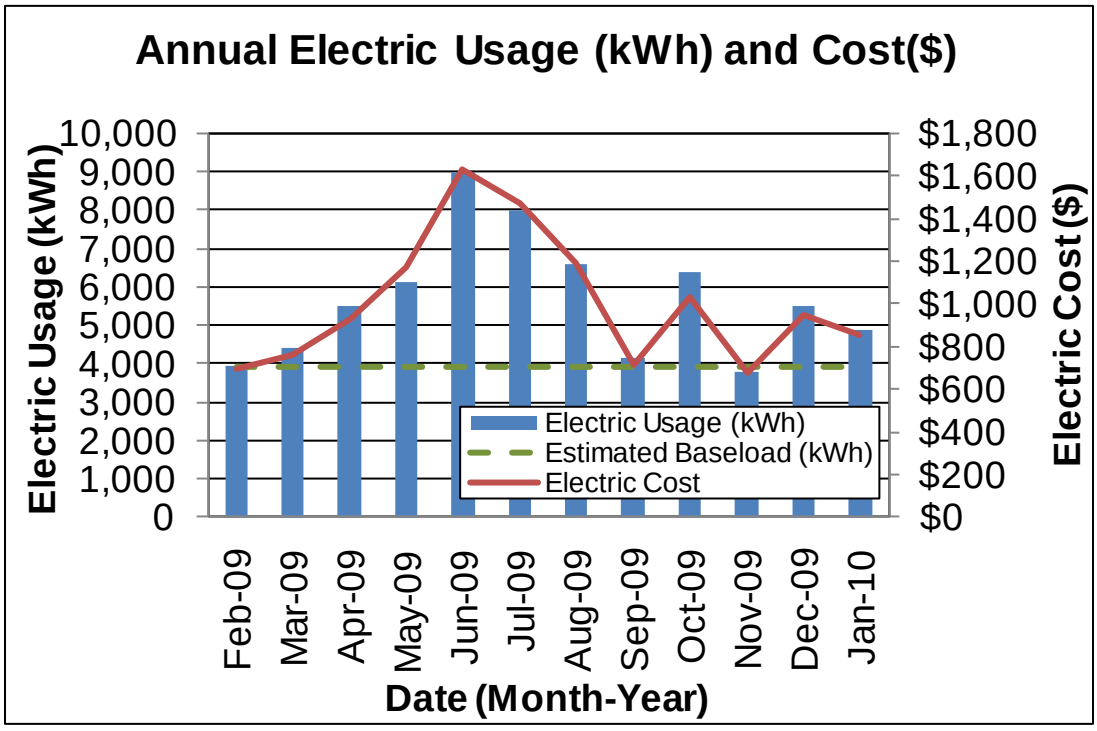
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

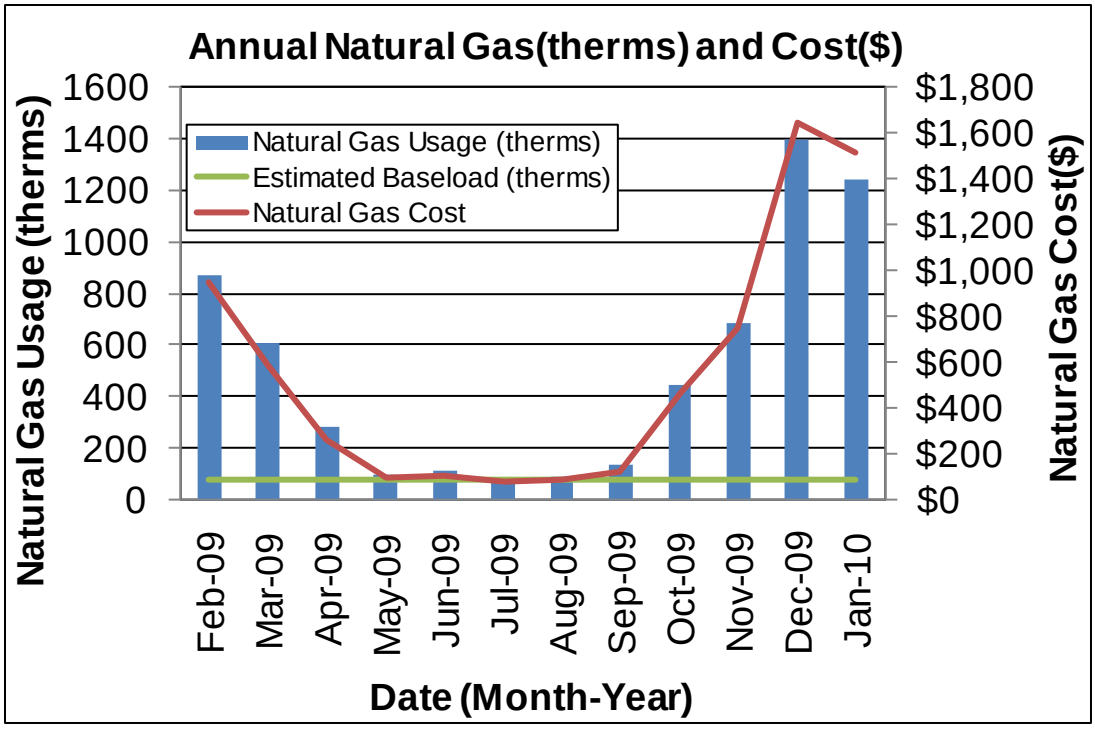
Electricity - The Borough Fire Department is currently served by one electric meter. The Borough Fire Department currently buys electricity from JCP&L at **an average aggregated rate of $0.177/kWh**. The Borough Fire Department purchased **approximately 68,120 kWh, or $12,062 worth of electricity,** in the previous year. The average monthly demand was 26.0 kW and the annual peak demand was 32.4 kW.

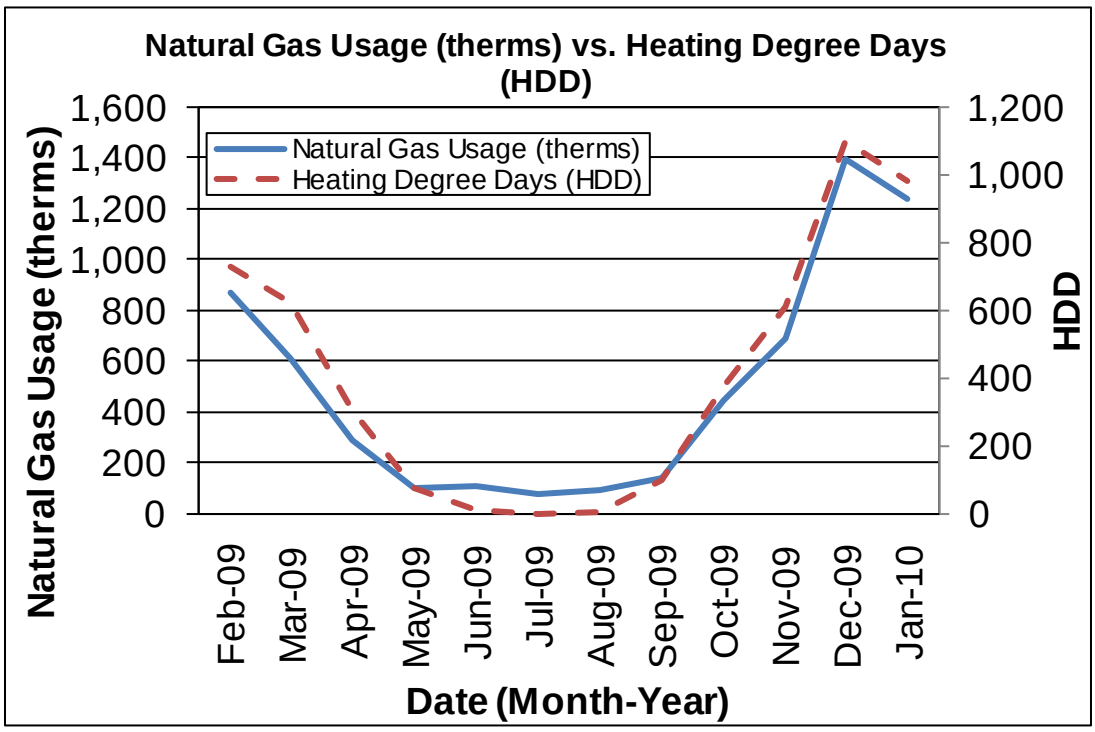
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Borough Fire Department.



Natural gas - The Borough Fire Department is currently served by one meter for natural gas. The Borough Fire Department currently buys natural gas from PSE&G at **an average aggregated rate of $1.111/therm**. The Borough Fire Department purchased **approximately 6,067 therms, or $6,743 worth of natural gas,** in the previous year.

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

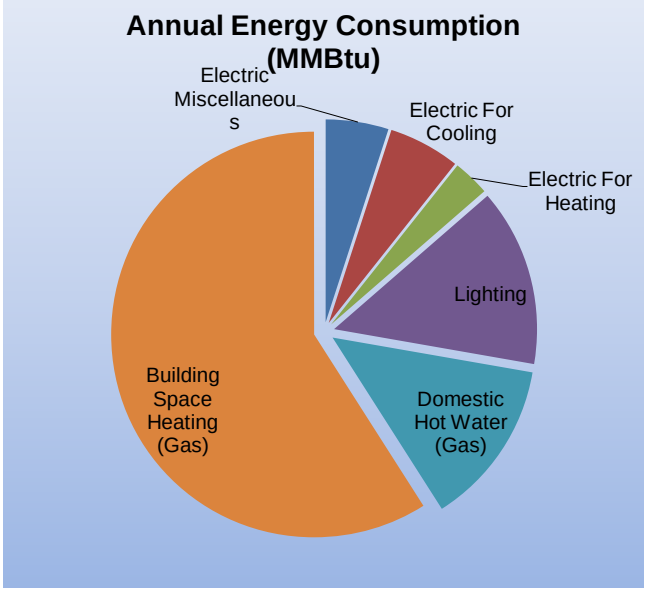


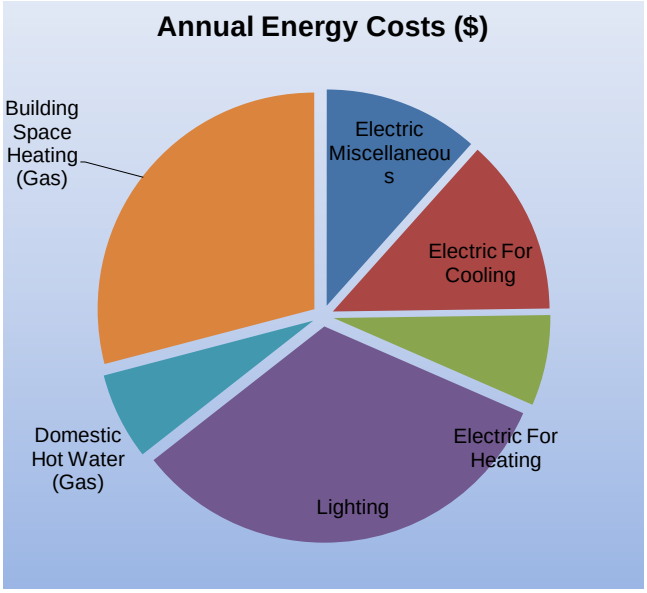


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the Borough Fire Department based on utility bills for the 12 month period. Note: electrical cost at $52/MMBtu of energy is nearly 5 times as expensive as natural gas at $11/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	42	5%	$2,172	12%	52
Electric For Cooling	48	6%	$2,470	13%	52
Electric For Heating	24	3%	$1,268	7%	52
Lighting	119	14%	$6,153	33%	52
Domestic Hot Water (Gas)	111	13%	$1,219	7%	11
Building Space Heating	494	59%	$5,444	29%	11
Totals	838	100%	$18,726	100%	
Total Electric Usage	232	28%	$12,063	64%	52
Total Gas Usage	605	72%	$6,663	36%	11
Totals	838	100%	$18,726	100%	

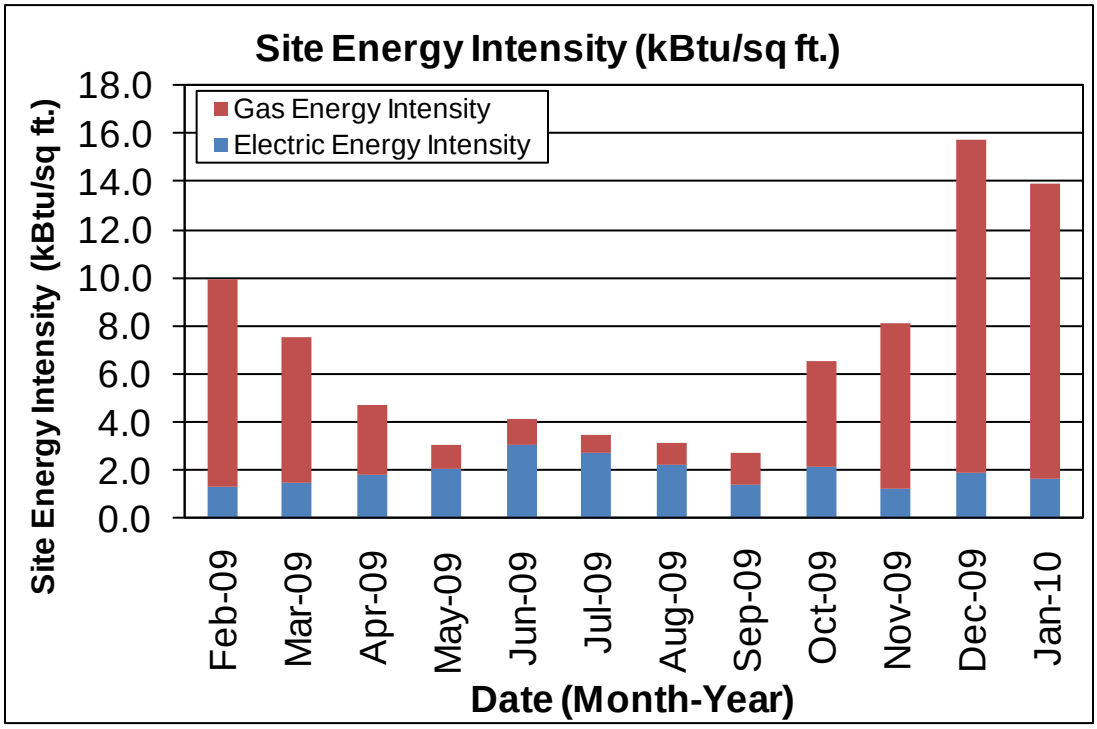




Energy benchmarking

SWA has entered energy information about the Borough Fire Department in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This Fire Station/Police Station facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Borough Fire Department is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 80.0 kBtu/ft^2-yr compared to the national average of a Fire Station/Police Department consuming 78.0 kBtu/ft^2-yr. See ECM section for guidance on how to improve the Borough Fire Department's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the Borough of Chatham 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 Borough Fire Department reach this goal.



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

Tariff analysis

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

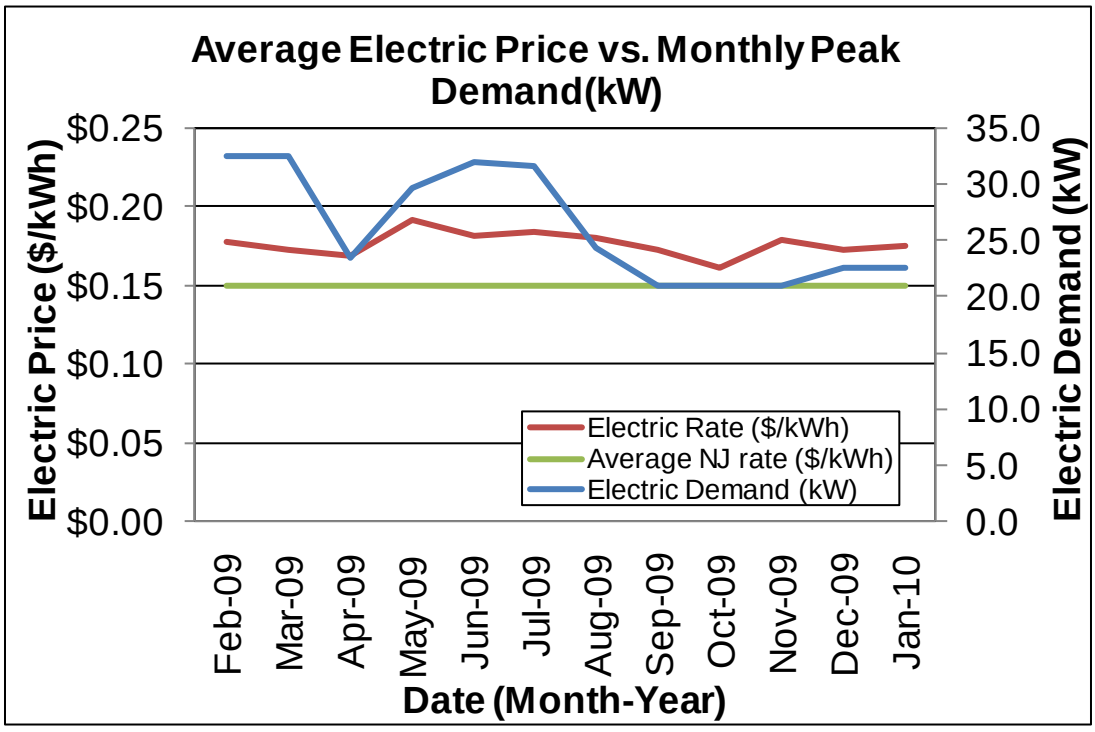
Tariff analysis is performed to determine if the rate that a building is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by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

PSE&G 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 Borough of Chatham is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the Borough Fire Department pays for fixed costs such as meter reading charges during the summer months. The Borough Fire Department 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.

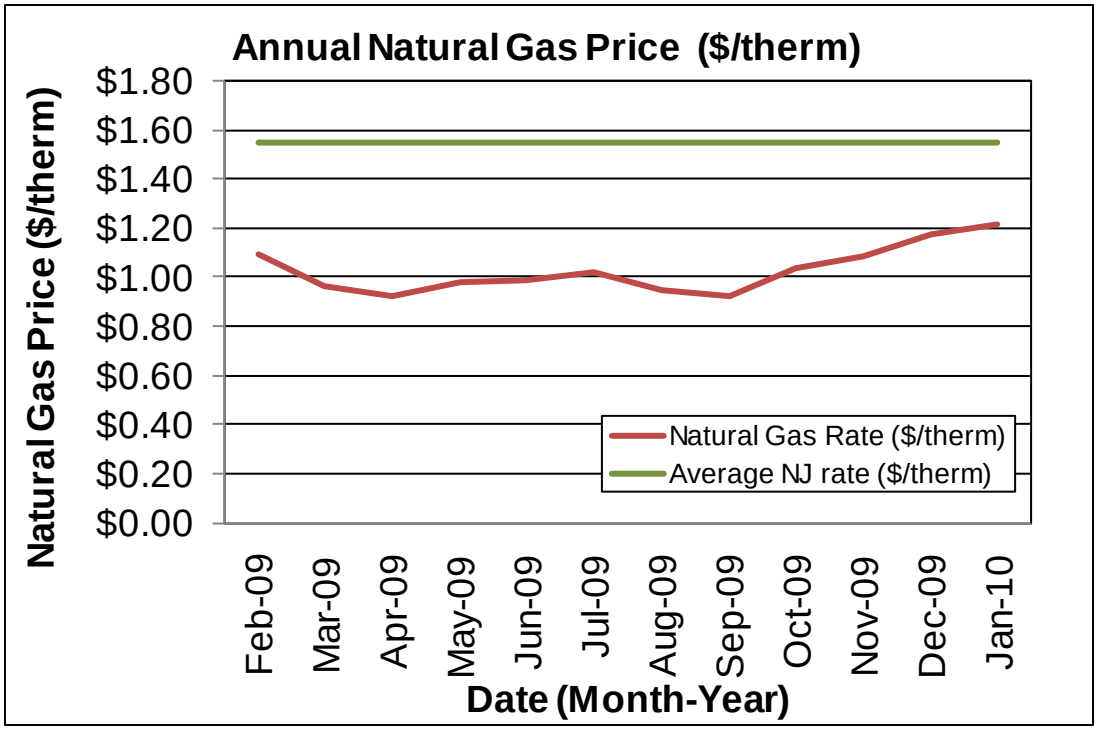
Energy Procurement strategies

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 Borough Fire Department pays a rate of $0.177/kWh. The Borough Fire Department's annual electric utility costs are $1,845 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 16% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while the Borough Fire Department pays a competitive rate of $1.111/therm. Natural gas bill analysis shows fluctuations up to 24% 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 Borough Fire Department further explore opportunities of purchasing electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Borough Fire Department. Appendix C contains a complete list of third-party energy suppliers for the Borough of Chatham service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

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

Based on visits from SWA on April 7, 12 and 22, 2010, the following data was collected and analyzed.

Borough Fire Department Characteristics

The partial two-story, (slab on grade), 10,100 square feet Chatham Fire Department building was originally constructed in 1959 with additions/alterations completed in 1998. It houses four front truck bays, one side garage bay, offices, a kitchen, a lounge, meeting and recreation rooms and bathrooms.

Front Façade

Left Side Façade

Rear Façade

Right Side Façade

2.1 Borough Fire Department Occupancy Profiles

Its occupancy is approximately 2 to 5 volunteers at most times and a fulltime daytime fireman. There are periods of time when the building is unoccupied. Volunteer firemen are called in for

emergency response via beepers. The Borough Fire Department responds to approximately 250 callouts a year.

Borough Fire Department Envelope

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

Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer and some wood frame accents, over concrete block with no detectable insulation. The interior is mostly painted CMU (Concrete Masonry Unit) in the garage areas and synthetic wood-like wall panels on the 2nd floor.

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

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

Roof

The Borough Fire Department's roof is predominantly a flat (without parapet) over steel decking, with a dark-colored EPDM single membrane finish. It was replaced approximately 10 years ago. No detectable ceiling insulation or roof insulation was recorded. Other parts of the Borough Fire Department are also covered by a flat roof (without parapet) over steel decking with a hot tar, gravel finish with no evidence of roof or attic insulation. This roof is original and has not been replaced.

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 condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues on original roof areas.

The following specific roof problem spots were identified:

Membrane de-lamination where old and new roof membranes meet

Uncontrolled mold growth on roof, indicating standing water

Base

The Borough Fire Department'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 Borough Fire Department's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

Windows

The Borough Fire Department contains basically two different types of windows.

1. Most double-hung type windows with vinyl frame clear double glazing and interior mini blinds. The windows are located on the front and left facade and were replaced approximately 20 years ago.

2. Several are double-hung type windows with vinyl frame, clear double glazing and interior mini blinds. The windows are located rear and right facade and were replaced approximately 10 years ago.

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

There are several older windows that sag and do not properly shut. They should be repaired or replaced.

Exterior doors

The Borough Fire Department contains several different types of exterior doors.

1. One insulated aluminum type exterior door. It is located at the front entrance and was replaced approximately 10 years ago.

2. One wood type exterior door. It is located on the left side of the Borough Fire Department and is original.

3. One aluminum type double door exterior door. It is located in the rear of the Borough Fire Department and was replaced approximately 20 years ago.

4. Four aluminum type garage doors. They are located in the front of the Borough Fire Department and were replaced approximately 20 years ago.

   All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good 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:

Worn weather-stripping; light visible through garage door

Missing/worn weather-stripping along bottom of exterior door in main garage area

Borough Fire Department air-tightness

Overall the field auditors found the Borough Fire Department to be reasonably air-tight, considering the Borough Fire Department's use and occupancy, as described in more detail earlier in this chapter.

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

Mechanical Systems

Heating Ventilation Air Conditioning

There were no comfort issues expressed by the Fire Department occupants at the time of the field visit. Based on the occupancy and use of the building, the existing HVAC systems provide adequate conditioning for the building. One rooftop make-up air unit located over the first floor Commons Room was reported to be damaged/broken and has since been disconnected.

Equipment

The building is heated and cooled primarily by two (2) packaged gas-fired / DX cooling rooftop units, a DX cooling only rooftop unit, a gas-fired hot water boiler that provides heating hot water to several hot water radiators and cabinet unit heaters throughout the building, and a radiant floor heating system in the main garage. The two (2) packaged rooftop units are near their end of life. The boiler should be replaced since it is likely that it has a shorter than normal life expectancy due to its conversion from coal to natural gas. A comprehensive equipment list can be found in Appendix A.

The two (2) gas-fired packaged rooftop HVAC units contain natural gas burners for heating and direct expansion (DX) systems for cooling, made up of evaporators, condensers, and refrigeration loops. The single cooling only rooftop unit includes only a DX system. In the heating mode, the burner provides heat to the passing air through the combustion of natural gas. In the cooling mode, the refrigerant absorbs heat from the passing air in the evaporator coil and transfers the heat to the atmosphere in the condenser.

Packaged Rooftop HVAC Unit on West Side First Floor Roof

The cooling only rooftop unit serves the second floor offices. The unit was installed in 2001, is in fair to good condition, and has 40% of its expected useful life of 15 years, according to the 2007 ASHRAE Applications Handbook.

Cooling Only Rooftop Unit Serving the Second Floor Offices

In addition, there is a single thru-the-wall air conditioning unit located in the first floor office. The unit was installed in 2005 and is in good condition. The unit has half of its expected useful life of 10 years, according to the 2007 ASHRAE Applications Handbook.

In 1990 the original coal fired boiler was converted to natural gas. The converted gas-fired boiler is in fair condition, and has 30% remaining of its expected useful life of 30 years, according to the 2007 ASHRAE Applications Handbook. The boiler provides heating hot water to four (4) different zones in the building including the following areas: the main garage truck bays, the front stairwell, the first floor office and adjacent toilet room, the first floor Commons room, the second floor offices, and the second floor storage, shower, and toilet rooms. Each zone has a single pipe-mounted pump, each of which was installed in the last 2 years. The main garage truck bays are heated by three (3) wall-mounted hydronic cabinet unit heaters and a fourth cabinet unit heater is located in the front stairwell. The main garage truck bays are also heated by radiant floor heating. The remaining areas in the building which receive heating hot water from the gas-fired boiler are served by baseboard radiators.


Gas-fired Hot Water Boiler, Converted In 1990

In addition to the above systems, there is a gas-fired unit heater hung from the ceiling that serves the East side garage bay. The heater was installed in 1998 and is in fair to good condition. The unit is nearing the end of its expected useful life of 13 years, according to the 2007 ASHRAE Applications Handbook.

The various spaces of the building are provided ventilation by outside air intake louvers on the packaged rooftop units, and ducted outside air intakes paired with the cooking hoods that serve the two kitchens of the building. The packaged rooftop units have barometric relief dampers on the return section, which purge excess air out of the building in order to maintain pressure equilibrium. The fresh air quantities provided by the packaged rooftop units should be confirmed and adjusted if necessary to meet code.

There are six roof-mounted exhaust fans and a single sidewall exhaust fan which serve the toilet rooms, kitchen hoods, and general exhaust. The building exhaust fans vary in condition and estimated remaining operating life.

One of the Original Exhaust Fans Serving the Second Floor Area

The pair of toilet rooms adjacent to the Commons room are ventilated by a roof mounted exhaust fan installed in 1998. The garage bay toilet room is ventilated by a sidewall exhaust fan which was installed in 1998. Both fans appear to be in good operating condition. A pair of roof mounted exhaust fans serving the second floor and the second floor toilet and shower room were reported to be original to the building and are operating beyond their expected service lives. The Borough should install new exhaust fans and ductwork as part of a capital improvement project, utilizing the same type of system.

There are two (2) additional roof mounted exhaust fans which serve the second floor and the single toilet room on the second floor that were installed in 1999. Both fans are in good operating condition.

The two kitchens, one located on the first floor and the second located in the Recreation Room on the second floor, are ventilated by kitchen hood exhaust fans paired with fresh air intakes. The equipment serving the first floor kitchen was installed in 2005 and is in very good condition. The Recreation Room kitchen ventilation equipment was installed in 1999 and appears to be in good condition. This equipment is approximately halfway through its expected service life of 20 years, according to the 2007 ASHRAE Applications Handbook.

The main garage truck bays are ventilated by a ductless HEPA filter vehicle exhaust system. Each individual truck bay is served by one of the HEPA units. The system was installed in 2003 and strict filter replacement and maintenance should be performed to ensure that the individual units continue to function properly and adequately remove the vehicle exhaust present in the truck bays.

Distribution Systems

A typical rooftop unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through the furnace section before the conditioned air is distributed into the building spaces. The furnace is only active in the heating season and the DX system is only active in the cooling season. In between these seasons neither system may operate and only the blower will be active to provide fresh air to the building. Heating hot water is distributed to the various units throughout the building via pumps and associated hot water piping. Although the exact setup and design of the Borough Fire Department ‘s radiant floor system is not known and drawings are unavailable, a typical radiant floor system delivers heat through separate zones with PEX piping laid out below the floor.

Controls

The heating and cooling equipment is controlled by manual thermostats in several rooms throughout the building. In general, the thermostats were in fair to satisfactory condition. It is recommended that the Borough Fire Department consider replacing the manual thermostats with programmable thermostats in an effort to reduce energy consumption. When used properly, the programmable thermostats can eliminate wasted conditioning during unoccupied periods of time, such as most evenings or weekends. Also, an outdoor air temperature reset control for the boiler was not apparent during the field visit.

Domestic Hot Water

The domestic hot water (DHW) for the building is provided by one gas-fired A.O. Smith water heater with 48 gallon storage capacity located in the boiler room on the Main Level. This heater serves the toilet rooms and kitchens on both levels via a small circulator pump. The heater was installed in 1997 and is at the end of its expected lifespan.

Gas-fired Domestic Water Heater in Boiler Room

Electrical systems

Lighting

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

Interior Lighting - The Borough Fire Department currently contains mostly T12 fixtures with sporadic use of T8 fixtures, CFL's and Incandescent lights. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

T8 fixtures in Truck Bay; Incandescent

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

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

CFL

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 Borough Fire Department. Typically, appliances are referred to as "plug-load" equipment, since they are not inherent to the building's systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines, printers, etc. all create an electrical load on the building that is hard to separate out from the rest of the building's energy usage based on utility analysis.

Elevators

The Borough Fire Department does not have an installed elevator but does have an ADA lift on the staircase to the second floor.

Other electrical systems

Miscellaneous

The Borough Fire Department has several pieces of miscellaneous equipment that do not fit into the HVAC categories above. A pair of large electric hose dryer units, and a stacked clothes washer-dryer are located in the main garage bays, a commercial dishwasher is located in the first floor kitchen, and an air compressor unit is located in the building's boiler room. The hose dryers are circa 1960s and are in fair condition. The stacked washer/dryer and commercial dishwasher are both in fair to good condition. The air compressor was installed in 2006 and is in very good condition. Use of these pieces of equipment is minimal and thus do not make a major impact on the energy usage for the building.

Refrigeration Systems

There is a large quantity of refrigeration systems in the Fire Department. Some of the equipment is commercial grade, and the remaining pieces of equipment are residential refrigeration systems. Most of the commercial refrigeration equipment is located in the second floor Recreation Room, including an under counter refrigerator, a large chest cooler/refrigerator, and a commercial ice maker. An additional commercial refrigerator is located in the first floor kitchen. Some of the refrigerators/freezers/ice maker(s) are sporadically plugged in for large gatherings.

Cooking Equipment

Both kitchens make use of commercial grade cooking equipment. A pair of 6-burner gas-fired ranges and a dual top and bottom pizza oven are located in the first floor kitchen. The second floor kitchen contains a gas-fired grill and griddle machine.

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 the building's mechanical equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

3.1 Existing systems

Currently there are no renewable energy systems installed in the Borough Fire Department.

3.2 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 Borough Fire Department is a good candidate for a 21.85 kW Solar Panel installation. See ECM#6 for details.

Solar Thermal Collectors

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

Geothermal

The building is not a good candidate for geothermal installation. The system would not be cost effective since the system cost would be prohibitive as compared to the minimal usage and savings.

Combined Heat and Power

The Borough Fire Department 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 base-load to accommodate the electricity generated, as well as a means for using waste heat generated.

Wind

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

PROPOSED ENERGY CONSERVATION MEASURES

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

Recommendations: Energy Conservation Measures

ECM#	0-5 Year Payback ECMs
1	Upgrade 6 thermostats to programmable type in various building spaces
2	Install 1 beverage vending machine energy miser on the second floor
3	Upgrade 48 incandescent fixtures to CFLs
ECM#	**5-10 Year Payback ECMs**
4	Replace domestic water heater with 95% efficient unit
5	Replace 1 old kitchen/lounge refrigerator with 18 cu ft Energy Star model
6	Install 21.85 kW PV rooftop system with incentives
7	Replace 2 old kitchen/lounge freezers with 24 cu ft Energy Star models
8	Upgrade 32 T12 fixtures to T8 fixtures
ECM#	**>10 Year Payback (End of Life Cycle)**
9	Replace boiler with (2) 93% AFUE high efficiency condensing boilers
10	Replace Carrier 5-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit
11	Replace Carrier 6-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit

ECM#1: Upgrade 6 thermostats to programmable type in various building spaces

During the field audit, SWA completed a building HVAC controls analysis and observed spaces in the buildings where temperature is manually controlled without setbacks to reduce energy consumption during unoccupied periods of time, such as most evenings and weekends. Programmable thermostats offer an easy way to save energy when correctly used. By turning the thermostat setback 5-10 degrees F for eight hours at a stretch (at night), the heating bill can be reduced substantially (by a minimum of 5% per year). In the summer, the cooling bill can be reduced by keeping the conditioned space warmer when unoccupied, and cooling it down only when using the space. The savings from using a programmable thermostat is greater in milder climates than in more extreme climates. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor. The four spaces addressed in this ECM are offices and garages that currently have wall mounted thermostats.

Installation cost:

Estimated installed cost: $1,002 (includes $451 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1,002	none at this time	1,002	105	0.0	25	0.3	1,167	1,213	12	14,550	0.8	1,352	113	121	10,586	459

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumed a conservative 1/2% savings of heating/cooling loads and on the average 40 min/wk operational savings when systems are operating per pre-agreed settings vs. the building's occupants making more frequent adjustments based on individual comfort levels.

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#2: Install 1 beverage vending machine energy miser on the second floor

Energy vending miser devices are now available for conserving energy used by beverage vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $254 (includes $75 of labor)
Source of cost estimate: www.usatech.com and established costs

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
254	none at this time	254	1,400	0.5	0	0.5	0	248	12	2,974	1.0	1,071	89	98	2,116	2,507

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumes energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php .

Rebates/financial incentives:

- None at this time

Please see Appendix F for more information on Incentive Programs.

ECM#3: Upgrade 48 incandescent fixtures to CFLs

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting contains many inefficient incandescent lamps. SWA recommends that each incandescent lamp is replaced with a more efficient Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $1,440 (includes $1,080 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1,440	none at this time	1,440	5,581	2.1	0	1.9	175	1,163	5	5,814	1.2	304	61	76	3,736	9,993

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- None at this time

Please see Appendix F for more information on Incentive Programs.

ECM#4: Replace domestic water heater with 95% efficient unit

There is one natural gas floor-mounted domestic water heater located in the Boiler Room of the Borough Fire Department. The heater produces the domestic hot water for the building's toilet rooms as well as the kitchen sinks. The water heater utilizes a 48 gallon storage tank, was installed in 1997 and is in fair condition. Based on the age and expected service life of 10-15 years, the Borough Fire Department should consider replacing this heater with a more efficient (condensing type) gas-fired tank heater as part of a capital improvement plan.

Installation cost:

Estimated installed cost: $1,450 (includes $450 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1,500	50	1,450	0	0.0	229	2.3	0	254	13	3,307	5.7	128	10	15	1,184	2,524

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The new high efficiency gas fired water heater would operate with an efficiency of approximately 95%.

Rebates/financial incentives:

- NJ Clean Energy - Gas Water Heaters <50 Gal ($50 per water heater) - Maximum incentive amount is $50.

Please see Appendix F for more information on Incentive Programs.

ECM#5: Replace 1 old kitchen/lounge refrigerator with 18 cu ft Energy Star model

During the field audit, SWA inspected old refrigerators which were not Energy Star rated (using approximately 775 kWh/yr). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of existing old refrigerators with 18 cu. ft. top freezer refrigerators ENERGY STAR®, using approximately 425 kWh/yr, or equivalent. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

On April 28, 2008, the ENERGY STAR criteria changed for all full-size refrigerators. All refrigerators greater than 7.75 cubic feet must be at least 20% more efficient than the federal standard. Before April 28, 2008, refrigerators needed to be at least 15% more efficient than the federal standard. The criteria for freezers and compact refrigerators and freezers did not change.

Some of the refrigerators are sporadically plugged in for large gatherings.

Installation cost:

Estimated installed cost: $750 (includes $70 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Replace 1 old kitchen/lounge refrigerator in kind																
700	0	700	50	0.0	0	0.0	50	59	12	706	11.9	1	0	0	6	90
Incremental difference to replace 1 old kitchen/lounge refrigerator with 18 cu ft Energy Star model																
50	0	50	300	0.1	0	0.1	0	53	12	637	0.9	1174	98	106	587	537
Replace 1 old kitchen/lounge refrigerator with 18 cu ft Energy Star model																
750	**0**	**750**	**350**	**0.1**	**0**	**0.1**	**50**	**112**	**12**	**1,343**	**6.7**	**79**	**7**	**10**	**593**	**627**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumed annual labor and parts insurance for old refrigerators.

Rebates/financial incentives:

- None at this time

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install 21.85 kW PV rooftop system with incentives

Currently the Borough Fire Department does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month's 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. It is recommended at this time that the Borough Fire Department further review installing a 21.85 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Borough Fire Department may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SREC's at $600/MWh or best market offer.

The building has flat roof and available space for a 21.85 kW PV installation. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 21.85 kW system needs approximately 95 panels which would take up 1,666 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

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

Installation cost:

Estimated installed cost: $147,075 (includes $65,550 of labor)
Source of cost estimate: Similar projects.

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
163,875	16,800	147,075	20,909	21.9	N/A	7.1	0	15,701	25	92,522	9.4	85	3	8	57,161	28,645

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

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.80 / watt Solar PV application for systems 50 kW or less. Incentive amount for this application is $16,800 for the proposed option.

http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $12,000 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#7: Replace 2 old kitchen/lounge freezers with 24 cu ft Energy Star models

During the field audit, SWA inspected old freezers which were not Energy Star rated (using approximately 4,000 kWh/yr). Appliances, such as freezers, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of existing old freezers with 24 cu. ft. freezers ENERGY STAR®, using approximately 3,200 kWh/yr, or equivalent. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

On April 28, 2008, the ENERGY STAR criteria changed for all full-size refrigerators. The criteria for freezers and compact refrigerators and freezers did not change. Freezers with a volume of 7.75 cubic feet or greater still must be at least 10% more efficient than the federal standard and compact refrigerators and freezers still must be at least 20% more efficient than the federal standard.

Some of the freezers/ice maker(s) are sporadically plugged in for large gatherings.

Installation cost:

Estimated installed cost: $4,600 (includes $140 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Replace 2 old kitchen/lounge freezers in kind																
4,000	0	4,000	200	0.1	0	0.1	200	235	12	2,825	17.0	-29	-2	-5	-1,632	358
Incremental difference to replace 2 old kitchen/lounge freezers with 24 cu ft Energy Star models																
600	0	600	1,400	0.5	0	0.5	0	248	12	2,974	2.4	396	33	41	1,780	2,507
Replace 2 old kitchen/lounge freezers with 24 cu ft Energy Star models																
4,600	**0**	**4,600**	**1,600**	**0.6**	**0**	**0.5**	**200**	**483**	**12**	**5,798**	**9.5**	**26**	**2**	**4**	**148**	**2,865**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumed annual labor and parts insurance for old freezers

Rebates/financial incentives:

- None at this time

Please see Appendix F for more information on Incentive Programs.

ECM#8: Upgrade 32 T12 fixtures to T8 fixtures

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting contains over 30 inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $3,840 (includes $2,496 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4,640	800	3,840	1,410	0.5	0	0.5	140	390	15	5,844	9.9	52	3	6	721	2,525

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

Rebates/financial incentives:

- NJ Clean Energy - T12 to T8 ($25 per fixture) - Maximum incentive amount - $800

Please see Appendix F for more information on Incentive Programs.

ECM#9: Replace boiler with (2) 93% AFUE high efficiency condensing boilers

The existing boiler in the Boiler room was converted from coal to natural gas in 1990 and is over halfway through its expected service life and is relatively inefficient as compared to modern condensing boilers. In addition , outdoor temperature reset controld were not observed. This boiler should be considered for replacement to achieve energy savings. The initial efficiency of the existing boiler is approximately 75%, but it can be assumed that in the time since its installation, it has degraded to an efficiency of about 65%. An upgrade to a pair of condensing boilers of minimum 85% combustion efficiency each should be considered by the Borough Fire Department as a means of energy conservation.

The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% at the worst case boiler operating conditions, such as mid-fire or high-fire conditions with a return water temperature in the range of 140-160 degrees Fahrenheit, and efficiencies of up to 95% achievable with lower return water temperatures. The boilers should be Low NOx certified with a 5:1 turndown burner, PVC direct venting and direct exhaust, hydronic safety controls and interface systems. The boilers shall have compact design for easy retrofit installation, with sectional aluminum block, ASME relief valve, stainless steel burner as a minimum. The boiler should be specified with factory controls that include outdoor temperature reset. The air blower should be variable speed combustion with easily removable access panels.

Installation cost:

Estimated installed cost: $14,080 (includes $4,500 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
15,000	920	14,080	0	0.0	1,116	11.0	0	1,240	25	30,997	11.4	120	5	7	6,819	12,302

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the day of the field visit and using the billing analysis and that the boiler will be replaced with (2) 230 MBH input capacity condensing boilers.

Rebates/financial incentives:

NJ Clean Energy - Gas-fired boilers > 300 MBH ($2.00 per MBH, but no less than $300/unit)
Maximum incentive amount is $920.

Please see Appendix F for more information on Incentive Programs.

ECM#10: Replace Carrier 5-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit

and

ECM#11: Replace Carrier 6-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit

The Bar/Recreation Room, and 1st floor Kitchen, bathrooms and Commons room are all heated and cooled by packaged gas-fired heating/DX cooling rooftop units located on the roof above the associated building zone. Both of these pieces of equipment were installed in 1998 and are nearing the end of their expected service lives of 15 years. SWA recommends replacement of the two packaged rooftop units to gain increase in operating efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life-cycle energy savings opportunity.

The current equipment is operating with a cooling Seasonal Energy Efficiency Ratio (SEER) of approximately 9.0 - 11.0. The new equipment should have a minimum 14.0 EER rating. The higher SEER will involve increased cost for the equipment over units with lower SEER. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

Installation cost:

Estimated installed cost (5-ton Unit): $10,500 (includes $3,150 of labor)
Estimated installed cost (6-ton Unit): $12,600 (includes $3,780 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Scenario #1: Replace Existing 5-ton Carrier Rooftop Unit with a 13.0 SEER Unit																
8,000	0	8,000	2,462	0.9	0	0.8	0	436	15	6,537	18.4	-18	-1	-2	-2,783	4,408
Scenario #2: Incremental Cost to Replace Existing 5-ton Carrier Rooftop Unit with a 15.0 SEER Unit vs. 13.0 SEER Unit																
2,500	460	2,040	738	0.3	0	0.2	0	131	15	1,959	15.6	-4	0	0	-487	1,321
Scenario #3: Replace Existing 5-ton Carrier Rooftop Unit with a 15.0 SEER Unit																
10,500	**460**	**10,040**	**3,200**	**1.2**	**0**	**1.1**	**0**	**566**	**15**	**8,496**	**17.7**	**-15**	**-1**	**-2**	**-3,270**	**5,730**

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Scenario #1: Replace Existing 6-ton Carrier Rooftop Unit with a 13.0 SEER Unit																
9,600	438	9,162	1,208	0.5	0	0.4	0	214	15	3,207	42.8	-65	-4	-11	-6,440	2,163
Scenario #2: Incremental Cost to Replace Existing 6-ton Carrier Rooftop Unit with a 15.0 SEER Unit vs. 13.0 SEER Unit																
3,000	0	3,000	887	0.3	0	0.3	0	157	15	2,355	19.1	-22	-1	-3	-1,117	1,588
Scenario #3: Replace Existing 6-ton Carrier Rooftop Unit with a 15.0 SEER Unit																
12,600	**438**	**12,162**	**2,095**	**0.8**	**0**	**0.7**	**0**	**371**	**15**	**5,562**	**32.8**	**-54**	**-4**	**-8**	**-7,557**	**3,751**

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis, and by estimating the total of 1,200 cooling hours for one year using weather bin data for Newark, NJ.

Rebates/financial incentives:

5-ton Unit:

NJ Clean Energy - Electric Unitary HVAC <5.4 tons and Min. 14.0 SEER ($92/ton) Maximum incentive amount is $460.

6-ton Unit:

NJ Clean Energy – Electric Unitary HVAC >5.5 tons to <11.25 tons and Min. 11.5 SEER ($73/ton) Maximum incentive amount is $438.

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

Capital Improvements are recommendations for the Borough Fire Department 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 Borough Fire Department renovations. SWA recommends the following capital improvements for the Borough Fire Department:

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

- Replace roof finish due to age and condition.

- Replace windows installed over 15 years ago with a low-E, double glazed type.

- Add insulation to second floor ceiling. SWA suggests applying closed-cell spray-foam (R-19 min.) to the underside of rafters.

- Replace heating terminal units - such as perimeter baseboard radiators located in the offices on the first and second floors and the cabinet hydronic unit heaters in the garage. This equipment is in fair condition and is beyond its expected service life. Age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended to improve the overall efficiency of the heating system. This is a replacement in kind recommendation which offers negligible energy savings

- Replace toilet exhaust fans and ductwork serving the second floor - this equipment is run by fractional horsepower motors and the run hours are not significant, so the replacements cannot be justified by energy savings alone and there are no NJ Clean Energy rebates available. However, due to the age and condition of the equipment, replacement is recommended.

- Install CO detectors/alarms in the engine bays and nearby spaces. Connect high level signals to nearby exhaust fans wherever possible.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current Borough Fire Department 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.

- Overgrown ground vegetation should be trimmed/removed to not touch or block wall surfaces from necessary access, ventilation and sunlight.

- Maintain weather-stripping around all exterior doors and roof hatches.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

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

- Provide weather-stripping/air-sealing - 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.

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

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

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

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

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

- Water levels in the expansion tanks and the integrity of the tank bladders should be checked to confirm proper operation.

- Tighten belts on exhaust fans - tightening belts on belt-driven exhaust fans can maximize overall efficiency of the equipment.

- Change filters in rooftop units and HEPA filter units monthly to ensure efficient operation of the fan. For the rooftop units this will also ensure adequate air delivery to the space and avoid overheating of the rooftop unit’s heat exchanger, which can cause cracking and require replacement.

- Boiler room and building piping insulation - Insulate un-insulated hot piping in the Boiler room and throughout the building to efficiently deliver hot water from the boiler and DHW heater where required while at the same time providing personnel protection.

APPENDIX A: EQUIPMENT LIST
Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating / Cooling	Rooftop Unit #1 – 11.0 EER	Carrier M# 48HJD007-- -531 S# 4698G20606 32.8MCA 40MOCP 72MBH input 59.04MBH output	Natural Gas/ Electric	South High Roof	Bar / Rec Room - 2nd Floor	1998	20%
Ventilation	Exhaust Fan #1 – Est. 90% eff.	Dayton M# 4HZ37 115V 1/6HP 2.3A	Electric	South High Roof	Bar / Rec Room Kitchen - 2nd Floor	1999	45%
Ventilation	Air Intake 'Direct Drive Blower' – Est. 90% eff.	Dayton M# 5C091B 115V 1/4HP 4A 1075RPM	Electric	South High Roof	Bar / Rec Room Kitchen - 2nd Floor	1999	45%
Ventilation	Exhaust Fan #2 – Est. 90% eff.	Penn Ventilation Companies M# FX08SR	Electric	East High Roof	Single Toilet Room - 2nd Floor	1999	45%
Ventilation	Exhaust Fan #3 – Est. 90% eff.	Penn Ventilation Companies M# FX08SR	Electric	East High Roof	General Exhaust	1999	45%
Ventilation	Exhaust Fan #4 – Est. 75% eff.	Jenn-Air M# 241 BRCG 115V 1ph 4.2A	Electric	East High Roof	General Exhaust	1959	0% - beyond expected useful life
Cooling	Rooftop Unit #2 – 10 SEER / 9.10 EER	York: Sunline 2000 M# D4CE060A25A S# NLKM114280 6lbs 8oz. R-22 refrigerant	Electric	East High Roof	2nd Floor Offices	2001	40%
Ventilation	Exhaust Fan #5 – Est. 75% eff.	Jenn-Air M# 70CR0T 115V 1ph. 10.3A	Electric	East High Roof	2nd Floor Toilet Room & Shower	1959	0% - beyond expected useful life
Heating	Make-up Air Unit	Reznor (no nameplate information) has been disconnected	Natural Gas	West Low Roof	Commons Room	1998	0%
Ventilation	Exhaust Fan #6	Penn Ventilation Companies M# FX13BHFT	Electric	West Low Roof	Kitchen - 1st Floor	2005	75%

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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating / Cooling	Rooftop Unit #3 – Est. 9.0 EER	Carrier M# 48HJD006 S# 3398G20589 208V 3ph. 28.9MCA 35MOCP 10lbs R-22 refrigerant 72MBH input 59.04MBH output	Natural Gas/ Electric	West Low Roof	1st Floor - Bathrooms, Common Area, & Kitchen	1998	20%
Ventilation	Exhaust Fan #7 – Est. 90% eff.	Penn Ventilation Companies M# FX10SR	Electric	West Low Roof	Toilet Rooms - 1st Floor	1998	40%
Heating	Gas-fired Unit Heater – 80% efficiency	Reznor M# FE25 S# AXF66M4N79 745X 25MBH input 20MBH output	Natural Gas	East Side Garage Bay	East Side Garage Bay	1998	5%
Ventilation	(4) Engine Exhaust Removal HEPA Filter Systems	Air Vacuum Corporation (no nameplate available)	Electric	Main Garage Bays	Main Garage Bays	2003	65%
Heating	Radiant Floor Heating	(unknown)	Electric	Main Garage Bay	Main Garage Bay	1998	55%
Refriger.	Commercial Refrigerator	True M# T-23 S# 1-2473364 Ref. Unit # AE4440Y 12oz. R134a refrigerant 115V 1ph. 1/3HP 7.5A	Electric	Kitchen - 1st Floor	Kitchen - 1st Floor	1999	40%
Refriger.	Residential Freezer	Woods M# V15WUA1E1 S# 00891770KE 6oz. R134a refrigerant 115V 2A	Electric	Back Bay Common Area	Back Bay Common Area	1998	15%
Refriger.	Chest Freezer	Coldspot (no nameplate available)	Electric	Back Bay Common Area	Back Bay Common Area	Circa 1980	0% - beyond expected useful life

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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	(4) Wall-mounted Hydronic Cabinet Unit Heaters	(no nameplate available)	Electric	Main Garage Bays & Front Stairwell	Main Garage Bays & Front Stairwell	1959	0% - beyond expected useful life
Ventilation	Sidewall Exhaust Fan	(fractional HP) (no nameplate available)	Electric	1st Floor Lavatory	Garage Bay Lavatory	1998	40%
Heating	Hydronic Baseboard Radiators	(no nameplate available)	Hot Water	1st Floor: Office, Lavatory, and Front Stiarwell	1st Floor: Office, Garage Bay Lavatory, and Front Stairwell	1959	0% - beyond expected useful life
Cooling	Thru-wall Air Conditioning Unit	Panasonic M# 302KA05021	Electric	1st Floor Office	1st Floor Office	2005	50%
Heating	Hydronic Baseboard Radiators	(no nameplate available)	Hot Water	Commons Room	Commons Room	1959	0% - beyond expected useful life
Misc.	Air Compressor	460V 3ph. 7-1/2HP NEMA 85.5% efficiency motor	Electric	Boiler Room	Boiler Room	2006	80%
Heating	Sectional Hot Water Boiler – 65% efficiency	HB Smith M# 25-250 (converted from coal to natural gas in 1990)	Natural Gas	Boiler Room	Hydronic heaters throughout building	1959, Converted in 1990	0% (30%)
Heating	Gas Burner	American Burner M# 0E-C4LH0 400-1,000MBH input 115V 1ph. 8A	Natural Gas	Boiler Room	Boiler	1990	5%
Heating	(4) Heating Hot Water Circulator Pumps – Est. 92% eff.	Bell & Gosset 115V 1ph. 1/4HP 3A ea.	Electric	Boiler Room	Hydronic heaters throughout building	2008	90%
Domestic Hot Water	Hot Water Heater – Est. 75% eff.	A.O. Smith M# PGXT50224 S#MC970063018224 48 gal. capacity 60MBH input	Natural Gas	Boiler Room	Sinks throughout building	1997	0% - beyond expected useful life

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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Domestic Hot Water	Hot Water Heater Circulator Pump – Est. 90% eff.	Bell & Gosset Series 100 K19 (fractional HP)	Electric	Boiler Room	Sinks throughout building	1997	35%
Refriger.	Commercial Under-counter Refrigerator	Delfield M# UC4048 S# AIY501511-T 115V 5A 7oz. 404a refrigerant	Electric	2nd Floor Kitchen Area / Rec. Room	2nd Floor Kitchen Area / Rec. Room	1999	40%
Refriger.	Chest Cooler / Refrigerator	True M# TD-65-24 S# 1-3501340 Refrig. Unit # AEA4440YXA 115V 1ph. 1/3HP 7.3A 11oz. R134a refrigerant	Electric	2nd Floor Kitchen Area / Rec. Room	2nd Floor Kitchen Area / Rec. Room	2003	60%
Refriger.	Kegerator	Beverage Air M# BM23 115V 1/6HP 3.6A 4.74oz. R12 refrigerant	Electric	2nd Floor Kitchen Area / Rec. Room	2nd Floor Kitchen Area / Rec. Room	Circa 1990	0%
Refriger.	Commercial Ice Maker	Hoshizaki M# KM-450-MWB S# C3A398 115V 1ph. 20A 1lb. 10oz. 502 refrigerant	Electric	2nd Floor - Closet	2nd Floor Kitchen Area / Rec. Room	1990	0%
Refriger.	Residential Freezer	Kelvinator M# UFS101FM4W	Electric	2nd Floor - Storage Room	2nd Floor - Storage Room	Circa 1990	0%
Heating	Hydronic Baseboard Radiators	(no nameplate available)	Hot Water	2nd Floor - Offices, Lavatory, and Storage Room	2nd Floor - Offices, Lavatory, and Storage Room	1959	0% - beyond expected useful life
Lighting	See Details – Appendix B	-	Electric	See Details – Appendix B	Building	varies	Avg 20%

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

Appendix B: Lighting Study

Location			Existing Fixture Information											Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Truck Bay	Parabolic Ceiling Mounted	E	4'T8	24	4	32	Sw	12	260	5	3,192	9,959	N/A	Parabolic Ceiling Mounted	4'T8	E	Sw	24	4	32	12	260	5	3192	9959	0	0	0
2	1	Truck Bay	Parabolic Ceiling Mounted	E	4'T8	5	2	32	Sw	12	260	5	345	1,076	N/A	Parabolic Ceiling Mounted	4'T8	E	Sw	5	2	32	12	260	5	345	1076	0	0	0
3	1	Truck Bay	Exit Sign	S	LED	2	1	5	Sw	24	365	1	11	96	N/A	Exit Sign	LED	S	Sw	2	1	5	24	365	1	11	96	0	0	0
4	1	Meeting Rm	Exit Sign	S	LED	3	1	5	Sw	24	365	1	17	145	N/A	Exit Sign	LED	S	Sw	3	1	5	24	365	1	17	145	0	0	0
5	1	Meeting Rm	Parabolic Ceiling Mounted	M	4'T12	6	2	40	Sw	8	260	12	552	1,148	T8	Parabolic Ceiling Mounted	4'T8	E	Sw	6	2	32	8	260	5	414	861	287	0	287
6	1	Meeting Rm	Parabolic Ceiling Mounted	M	4'T12	5	4	40	Sw	8	260	12	860	1,789	T8	Parabolic Ceiling Mounted	4'T8	E	Sw	5	4	32	8	260	5	665	1383	406	0	406
7	1	Bathroom Men	Parabolic Ceiling Mounted	M	4'T12	2	4	40	DSw	9	260	12	344	805	T8	Parabolic Ceiling Mounted	4'T8	E	DSw	2	4	32	9	260	5	266	622	183	0	183
8	1	Bathroom Men	Parabolic Ceiling Mounted	M	2'T12	1	2	20	DSw	9	260	6	46	108	T8	Parabolic Ceiling Mounted	2'T8	E	DSw	1	2	17	9	260	2	36	84	23	0	23
9	1	Staircase	Ceiling Mounted	M	Circline - T12	2	1	40	Sw	12	260	12	104	324	N/A	Ceiling Mounted	Circline - T8	M	Sw	2	1	40	12	260	6	93	289	36	0	36
10	1	Staircase	Exit Sign	S	LED	1	1	5	Sw	24	365	1	6	48	N/A	Exit Sign	LED	S	Sw	1	1	5	24	365	1	6	48	0	0	0
11	1	Office	Ceiling Mounted	M	4'T12	6	2	40	Sw	8	260	12	552	1,148	T8	Ceiling Mounted	4'T8	E	Sw	6	2	32	8	260	5	414	861	287	0	287
12	1	Bathroom	Ceiling Mounted	S	Inc	3	3	60	Sw	9	260	0	540	1,264	CFL	Ceiling Mounted	CFL	S	Sw	3	3	20	9	260	0	180	421	842	0	842
13	1	Bathroom	Ceiling Mounted	M	4'T12	1	1	40	Sw	9	260	12	52	122	T8	Ceiling Mounted	4'T8	E	Sw	1	1	32	9	260	5	37	87	35	0	35
14	1	Bathroom	Ceiling Mounted	S	Inc	1	1	60	DSw	9	260	0	60	140	CFL	Ceiling Mounted	CFL	S	DSw	1	1	20	9	260	0	20	47	94	0	94
15	1	Boiler Rm	Ceiling Mounted	S	Inc	4	1	60	DSw	2	260	0	240	125	CFL	Ceiling Mounted	CFL	S	DSw	4	1	20	2	260	0	80	42	83	0	83
16	1	Utility Rm	Ceiling Mounted	M	4'T12	4	4	40	Sw	2	260	12	688	358	T8	Ceiling Mounted	4'T8	E	Sw	4	4	32	2	260	5	532	277	81	0	81
17	1	Storage Rm	Ceiling Mounted	M	4'T12	4	2	40	Sw	2	260	12	368	191	T8	Ceiling Mounted	4'T8	E	Sw	4	2	32	2	260	5	276	144	48	0	48
20	2	Staircase	Ceiling Mounted	M	2'T12	1	2	20	Sw	12	260	6	46	144	T8	Ceiling Mounted	2'T8	E	Sw	1	2	17	12	260	2	36	112	31	0	31
21	2	Staircase	Ceiling Mounted	S	CFL	1	1	13	Sw	12	260	0	13	41	N/A	Ceiling Mounted	CFL	S	Sw	1	1	13	12	260	0	13	41	0	0	0
22	2	Staircase	Ceiling Mounted	M	Circline - T12	2	1	40	Sw	12	260	12	104	324	N/A	Ceiling Mounted	Circline - T8	M	Sw	2	1	40	12	260	6	93	289	36	0	36
23	2	Lounge	Track	S	CFL	6	2	40	Sw	8	260	0	480	998	N/A	Track	CFL	S	Sw	6	2	40	8	260	0	480	998	0	0	0
24	2	Lounge	Ceiling Mounted	S	Inc	28	1	60	D	8	260	0	1,680	3,494	CFL	Ceiling Mounted	CFL	S	D	28	1	20	8	260	0	560	1165	2330	0	2330
25	2	Kitchen	Ceiling Mounted	S	Inc	1	1	60	D	9	260	0	60	140	CFL	Ceiling Mounted	CFL	S	D	1	1	20	9	260	0	20	47	94	0	94
26	2	Bathroom	Ceiling Mounted	M	2'T12	1	2	20	DSw	9	260	6	46	108	T8	Ceiling Mounted	2'T8	E	DSw	1	2	17	9	260	2	36	84	23	0	23
27	2	Lounge	Exit Sign	S	LED	2	1	5	N	24	260	1	11	69	N/A	Exit Sign	LED	S	N	2	1	5	24	260	1	11	69	0	0	0
28	2	Janitor's Closet	Ceiling Mounted	M	2'T12	1	2	20	Sw	2	260	6	46	24	T8	Ceiling Mounted	2'T8	E	Sw	1	2	17	2	260	2	36	19	5	0	5
29	2	Chief Office	Recessed Parabolic	S	CFL	3	2	40	Sw	9	260	0	240	562	N/A	Recessed Parabolic	CFL	S	Sw	3	2	40	9	260	0	240	562	0	0	0
30	2	Records	Recessed Parabolic	S	CFL	2	2	40	Sw	9	260	0	160	374	N/A	Recessed Parabolic	CFL	S	Sw	2	2	40	9	260	0	160	374	0	0	0
31	2	Hallway	Recessed Parabolic	S	CFL	3	2	40	Sw	12	260	0	240	749	N/A	Recessed Parabolic	CFL	S	Sw	3	2	40	12	260	0	240	749	0	0	0
32	2	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
33	2	Meeting Rm	Recessed Parabolic	S	CFL	4	2	40	Sw	8	260	0	320	666	N/A	Recessed Parabolic	CFL	S	Sw	4	2	40	8	260	0	320	666	0	0	0
34	2	Hallway	Recessed Parabolic	M	Circline - T12	2	2	40	Sw	12	260	12	184	574	N/A	Recessed Parabolic	Circline - T8	M	Sw	2	2	40	12	260	6	173	538	36	0	36
35	2	Bathroom	Ceiling Mounted	S	Inc	2	3	60	Sw	9	260	0	360	842	CFL	Ceiling Mounted	CFL	S	Sw	2	3	20	9	260	0	120	281	562	0	562
36	2	Staircase	Ceiling Mounted	M	Circline - T12	2	1	40	Sw	12	260	12	104	324	N/A	Ceiling Mounted	Circline - T8	M	Sw	2	1	40	12	260	6	93	289	36	0	36
37	2	Storage Rm	Ceiling Mounted	S	CFL	2	2	40	Sw	2	260	0	160	83	N/A	Ceiling Mounted	CFL	S	Sw	2	2	40	2	260	0	160	83	0	0	0
38	Ext	Exterior	Wall Mounted	S	CFL	2	2	13	PC	12	365	0	52	228	N/A	Wall Mounted	CFL	S	PC	2	2	13	12	365	0	52	228	0	0	0
39	Ext	Exterior	Wall Mounted	S	MH	5	2	75	PC	12	365	21	855	3,745	N/A	Wall Mounted	MH	S	PC	5	2	75	12	365	21	855	3745	0	0	0
40	Ext	Exterior	Wall Mounted	S	Inc	9	1	60	PC	12	365	0	540	2,365	CFL	Wall Mounted	CFL	S	PC	9	1	20	12	365	0	180	788	1577	0	1577
41	1	Kitchen	Ceiling Mounted	M	4'T12	6	3	40	Sw	8	260	12	792	1,647	T8	Ceiling Mounted	4'T8	E	Sw	6	3	32	8	260	5	606	1260	387	0	387
42	1	Back Garage	Ceiling Mounted	E	4'T8	2	4	32	Sw	8	260	5	266	553	N/A	Ceiling Mounted	4'T8	E	Sw	2	4	32	8	260	5	266	553	0	0	0
Totals:						**154**	**71**	**1,370**				**190**	**13,683**	**34,749**						**154**	**71**	#N/A			**102**	**10,465**	**27,615**	**7,134**	**0**	**7,134**

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

Proposed Lighting Summary Table		
Total Gross Floor Area (SF)		10,100
Average Power Cost ($/kWh)		0.1770
Exterior Lighting	**Existing**	**Proposed**
Exterior Annual Consumption (kWh)	6,338	4,761
Exterior Power (watts)	1,447	1,087
Total Interior Lighting	**Existing**	**Proposed**
Annual Consumption (kWh)	28,411	22,854
Lighting Power (watts)	12,236	9,378
Lighting Power Density (watts/SF)	1.21	0.93
Estimated Cost of Fixture Replacement ($)		5,280
Estimated Cost of Controls Improvements ($)		0
Total Consumption Cost Savings ($)		**3,119**

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.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
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

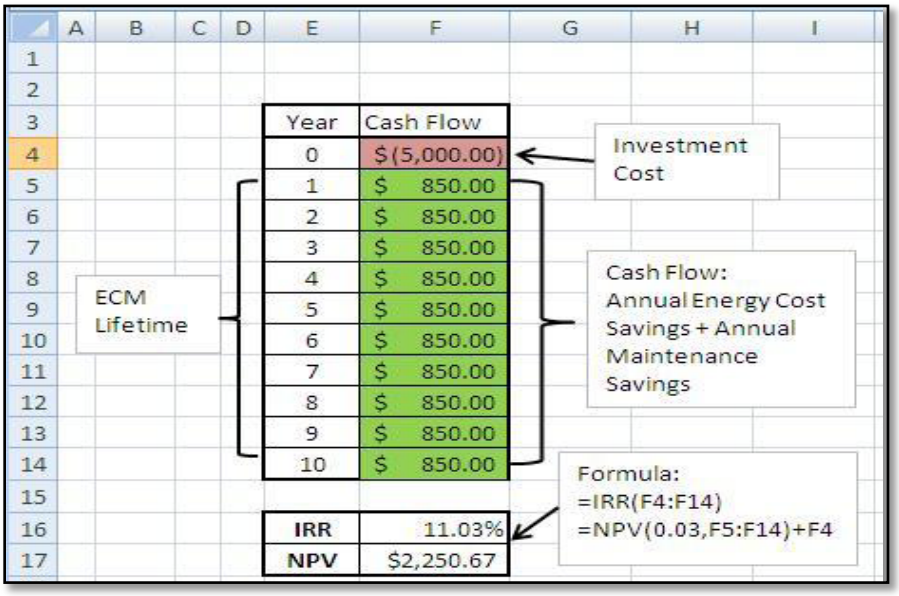
Calculation References

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

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) - Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of Chatham - Fire Department

Building ID: 2283015
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: May 11, 2010

Facility	Facility Owner	Primary Contact for this Facility
Borough of Chatham - Fire Department 1 Fire House Plaza Chatham, NJ 07928	N/A	N/A

Year Built: 1959
Gross Floor Area (ft²): 10,100

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	230,466
Natural Gas (kBtu)[4]	581,121
Total Energy (kBtu)	811,587
Energy Intensity[5]	
Site (kBtu/ft²/yr)	80
Source (kBtu/ft²/yr)	136
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	66
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-13%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

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

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 Borough 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-Borough Fire Departments/nj-smartstart-Borough Fire Departments.

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.

Federal and State Sponsored Programs

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

APPENDIX G: ENERGY CONSERVATION MEASURES

Recommended 0-5 Year Payback ECMs																		
ECM #	ECM description		est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Upgrade 6 thermostats to programmable type in various building spaces		1,002	none at this time	1,002	105	0.0	25	0.3	1,167	1,213	12	14,550	0.8	1,352	113	121	10,586	459
2	Install 1 beverage vending machine energy miser on the second floor		254	none at this time	254	1,400	0.5	0	0.5	0	248	12	2,974	1.0	1,071	89	98	2,116	2,507
3	Upgrade 48 incandescent fixtures to CFLs		1,440	none at this time	1,440	5,581	2.1	0	1.9	175	1,163	5	5,814	1.2	304	61	76	3,736	9,993
	Totals		**2,696**	**0**	**2,696**	**7,086**	**2.7**	**25**	**2.6**	**1,342**	**2,623**	**-**	**23,338**	**1.0**	**766**	**-**	**96**	**16,437**	**12,958**

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

Recommended 5-10 Year Payback ECMs																		
ECM #	ECM description		est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4	Replace domestic water heater with 95% efficient unit		1,500	50	1,450	0	0.0	229	2.3	0	254	13	3,307	5.7	128	10	15	1,184	2,524
5	Replace 1 old kitchen/lounge refrigerator with 18 cu ft Energy Star model		750	0	750	350	0.1	0	0.1	50	112	12	1,343	6.7	79	7	10	593	627
6	Install 21.85 kW PV rooftop system with incentives		163,875	16,800	147,075	20,909	21.9	N/A	7.1	0	15,701	25	92,522	9.4	85	3	8	57,161	28,645
7	Replace 2 old kitchen/lounge freezers with 24 cu ft Energy Star models		4,600	0	4,600	1,600	0.6	0	0.5	200	483	12	5,798	9.5	26	2	4	148	2,865
8	Upgrade 32 T12 fixtures to T8 fixtures		4,640	800	3,840	1,410	0.5	0	0.5	140	390	15	5,844	9.9	52	3	6	721	2,525
	Totals		**175,365**	**17,650**	**157,715**	**24,269**	**23.1**	**229**	**10.5**	**390**	**16,940**	**-**	**108,815**	**9.3**	**-31**	**-**	**7**	**57,782**	**37,186**

Recommended End of Life Cycle and >10 Year Payback ECMs																			
ECM #	ECM description		est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9	Replace boiler with (2) 93% AFUE high efficiency condensing boilers		15,000	920	14,080	0	0.0	1,116	11.0	0	1,240	25	30,997	11.4	120	5	7	6,819	12,302
10	Replace Carrier 5-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit		10,500	460	10,040	3,200	1.2	0	1.1	0	566	15	8,496	17.7	-15	-1	-2	-3,270	5,730
11	Replace Carrier 6-ton packaged gas-fired heating/electric cooling rooftop HVAC unit with a 15 SEER high efficiency unit		12,600	438	12,162	2,095	0.8	0	0.7	0	371	15	5,562	32.8	-54	-4	-8	-7,557	3,751
	Totals		**38,100**	**1,818**	**36,282**	**5,295**	**2.0**	**1,116**	**12.8**	**0**	**2,177**	**-**	**45,055**	**16.7**	**24**	**-**	**2**	**-4,009**	**21,782**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

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

Disclaimer

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

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