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Local Government Energy Program
Energy Audit Final Report

Borough of Red Bank

Borough Hall
90 Monmouth Street
Red Bank, NJ 07701

Project Number: LGEA73

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EXECUTIVE SUMMARY

The Red Bank Borough Hall is a four-story building with two partial basements comprising a total conditioned floor area of 24,751 square feet. The original structure was built in 1912, and there have been several renovations/additions since then, the latest in the 1970's and 1997. The following chart provides an overview of current energy usage in the building based on the analysis period of February 2009 through January 2010:

Table 1: State of Building - 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	549,120	734	N/A	90,852	80.0	1,947
Proposed	451,369	671	N/A	74,808	66.3	1,607
Savings	97,751	63	N/A	16,044	13.7	340
% Savings	18%	9%	N/A	18%	17%	17%

There may be energy procurement opportunities for the Red Bank Borough Hall to reduce annual utility costs, which are $7,347 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Borough Hall in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This mixed use building is comprised of non-eligible ("Other") space type. The resulting Site Energy Use Intensity is 80.0kBtu/sq ft yr, which is better than the average comparable building by 23%.

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	7,170	3.0	21,503	77,700
5-10 Year	24,751	7.0	172,314	98,012
Total	31,921	6.1	193,817	175,712

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 15 cars from the roads each year or avoiding the need of 428 trees to absorb the annual CO_2 generated.

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

- Capital Improvements
  - Replace roof finish due to age and condition, both above the 1st floor Dispatch area and 4th floor delaminated sections
  - Replace Cooling Tower with updated model
  - Replace one standard efficiency natural gas DHW heater with an ENERGY STAR® condensing heater

- Operations and Maintenance
  - Inspect and replace cracked/ineffective caulk at façade EIFS joints and at building base
  - Slope roof surface to drain effectively at time of reroofing. Maintain/inspect all roof surfaces on a regular basis. Repair/patch roof leakage area
  - Repair weather-stripping/air-sealing
  - Change filters in heat pumps monthly

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Red Bank Borough Hall. Based on the requirements of the LGEA program, the Red Bank Borough Hall must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The Red Bank Borough Hall should spend a minimum of $1,778 (or 25% of $7,110) worth of ECMs, net of other NJCEP incentives, to fulfill the obligations.

Financial Incentives and Other Program Opportunities

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

Table 3: Next Steps for the Borough Hall

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Upgrade 12 Incandescent Flood Light Fixtures to CFLs	Direct Install
Install 2 Beverage and 2 Snacks Vending Machine Energy Misers in the PD and 4th Floor Lunch Rooms	N/A
Install VFDs on System Circulator (P-1&2) 15 HP Motors	Direct Install
Upgrade One T12 Fixture to a T8 fixture	Smart Start, Direct Install
Install 22 Occupancy Sensors	Smart Start, Direct Install

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

- **Direct Install 2010 Program**: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.
- **Smart Start**: Most of energy savings equipment and design measures have moderate incentives under this program.
- **Renewable Energy Incentive Program**: Receive up to $0.80/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by PV renewable energy, receive a credit between $475 and $600. Also, receive up to $3.20/kWh toward installation cost for a Wind System.
- **Utility Sponsored Programs**: See available programs with NJ Natural Gas http://www.njng.com/save-energy-money/special_offers.asp and JCP&L http://www.firstenergycorp.com/Residential_and_Business/Products_and_Services/index.html
- **Energy Efficiency and Conservation Block Grant Rebate Program**: Provides up to $20,000 per local government toward energy saving measures; http://njcleanenergy.com/EECBG

Please refer to Appendix F for further details.

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, 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 Hall at 90 Monmouth Street, Red Bank, NJ 07701. The process of the audit included a facility visit on June 15, 2010 benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Borough of Red Bank to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Borough Hall. SWA also acknowledges that the Borough of Red Bank is a member of Sustainable Jersey and as such is very interested in energy conservation.

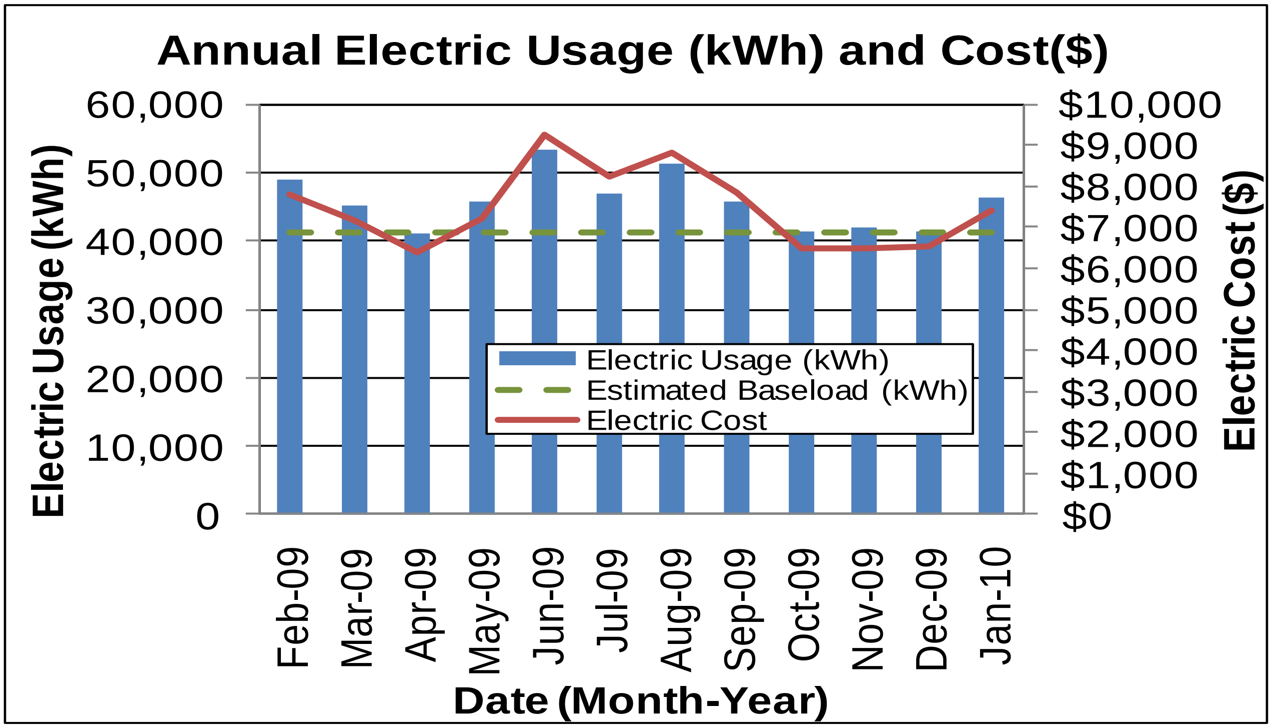
HISTORICAL ENERGY CONSUMPTION

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 Hall 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 building.

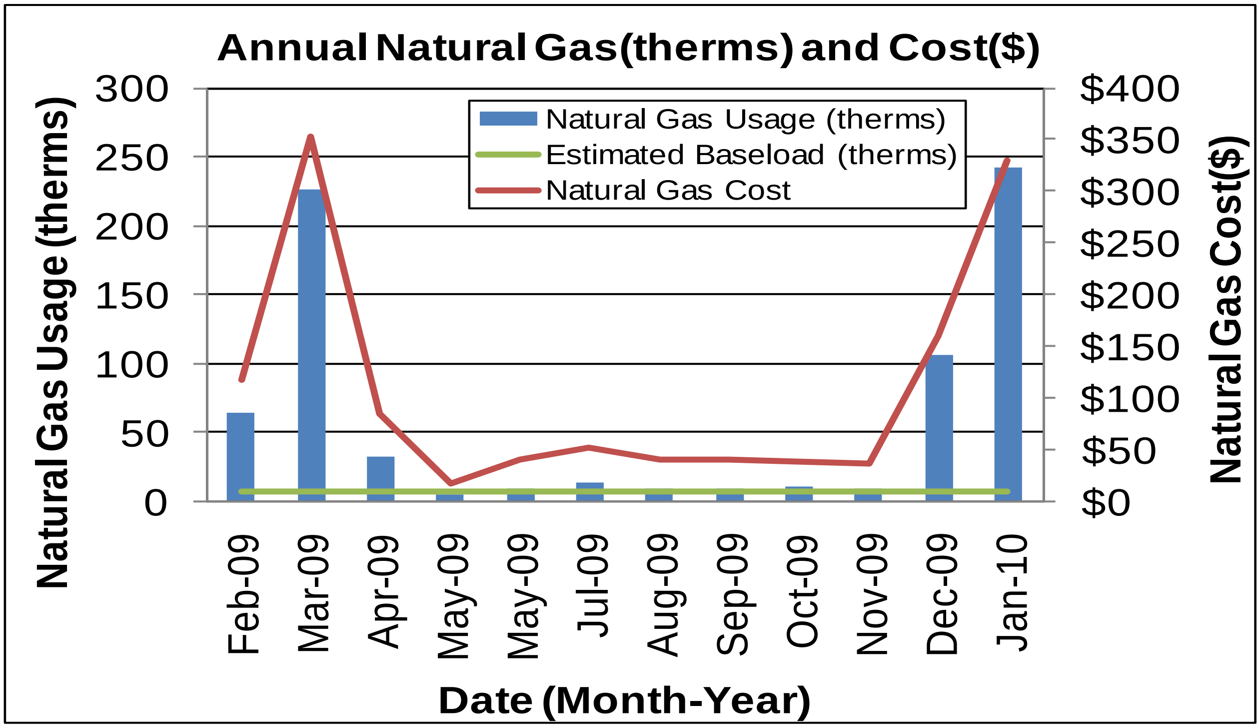
Electricity - The Borough Hall is currently served by one electric meter. The Borough Hall currently buys electricity from JCP&L at **an average aggregated rate of $0.163/kWh**. The Borough Hall purchased **approximately 549,120 kWh, or $89,549 worth of electricity,** in the previous year. The average monthly demand was 106 kW and the annual peak demand was 118 kW.

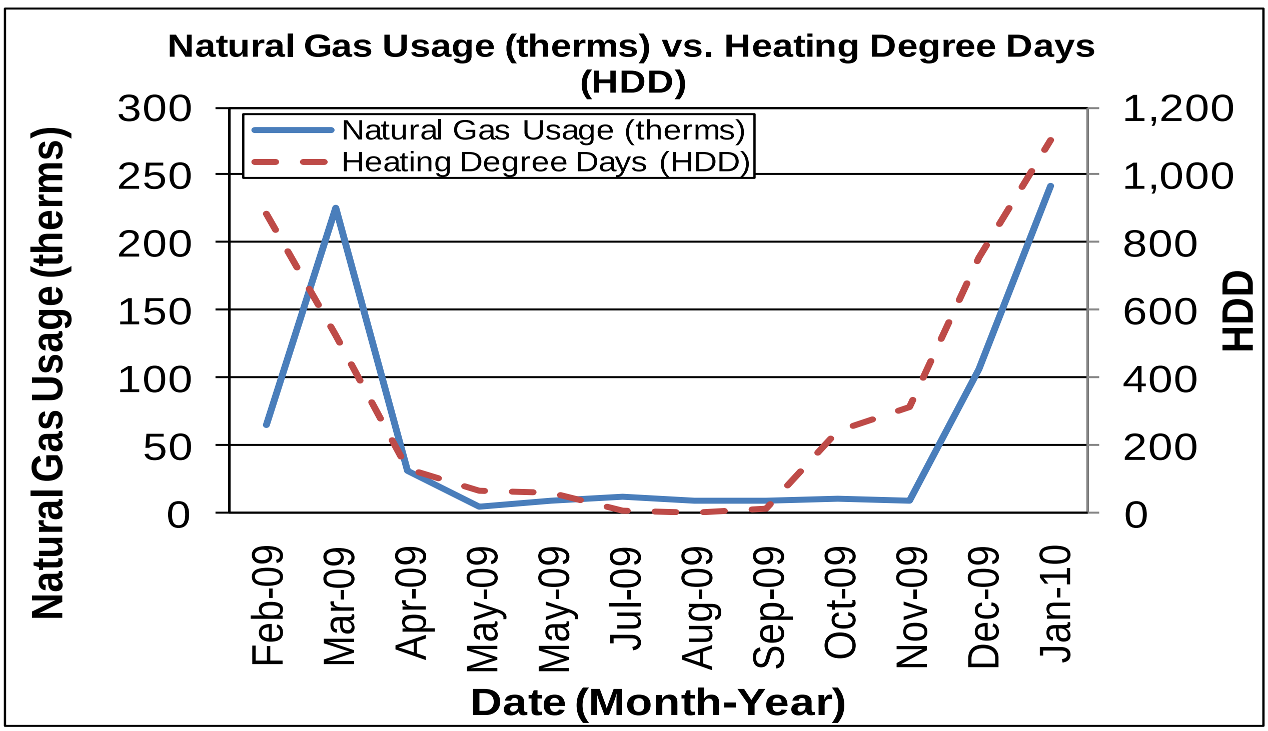
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base-load or minimum electric usage required to operate the Borough Hall.



Natural gas - The Borough Hall is currently served by one meter for natural gas. The Borough Hall currently buys natural gas from NJ Natural Gas Co. at **an average aggregated rate of $1.775/therm**. The Borough Hall purchased **approximately 734therms, or $1,303 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate base-load or minimum natural gas usage required to operate the Borough Hall.

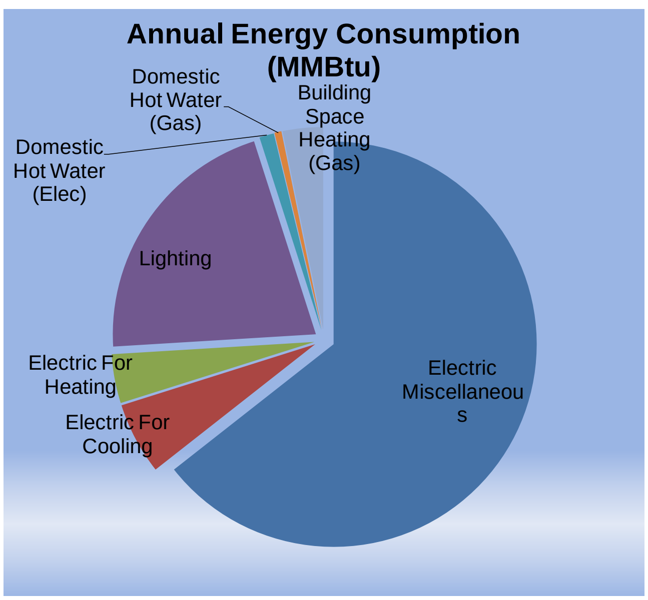


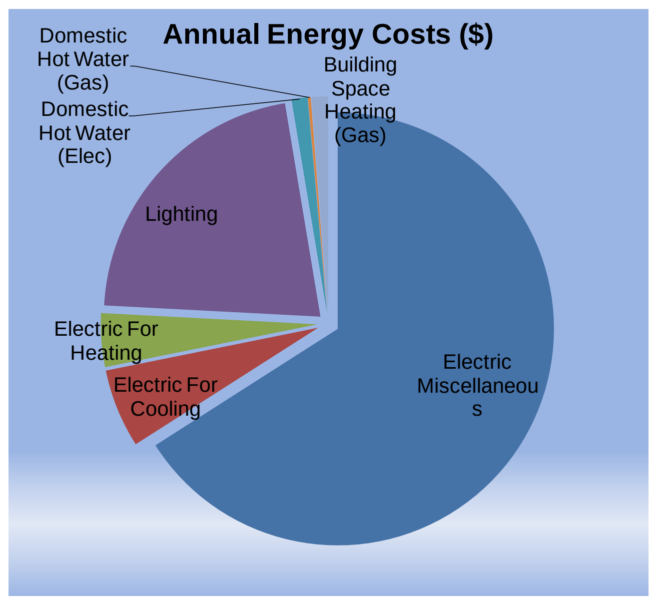


The previous chart shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the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

The following table and pie charts, and table show energy use for the Borough Hall based on utility bills for the 12 month period. Note: electrical cost at $48/MMBtu of energy is 2.7 times as expensive as natural gas at $18/MMBtu. Electrical Miscellaneous includes heat pumps operating all throughout the year.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	1,254	64%	$59,916	66%	48
Electric For Cooling	112	6%	$5,340	6%	48
Electric For Heating	76	4%	$3,636	4%	48
Lighting	410	21%	$19,577	22%	48
Domestic Hot Water (Elec)	23	1%	$1,080	1%	48
Domestic Hot Water (Gas)	11	1%	$192	0%	18
Building Space Heating (Gas)	63	3%	$1,111	1%	18
Totals	1,947	100%	$90,852	100%	
Total Electric Usage	1,874	96%	$89,549	99%	48
Total Gas Usage	73	4%	$1,303	1%	18
Totals	1,947	100%	$90,852	100%	

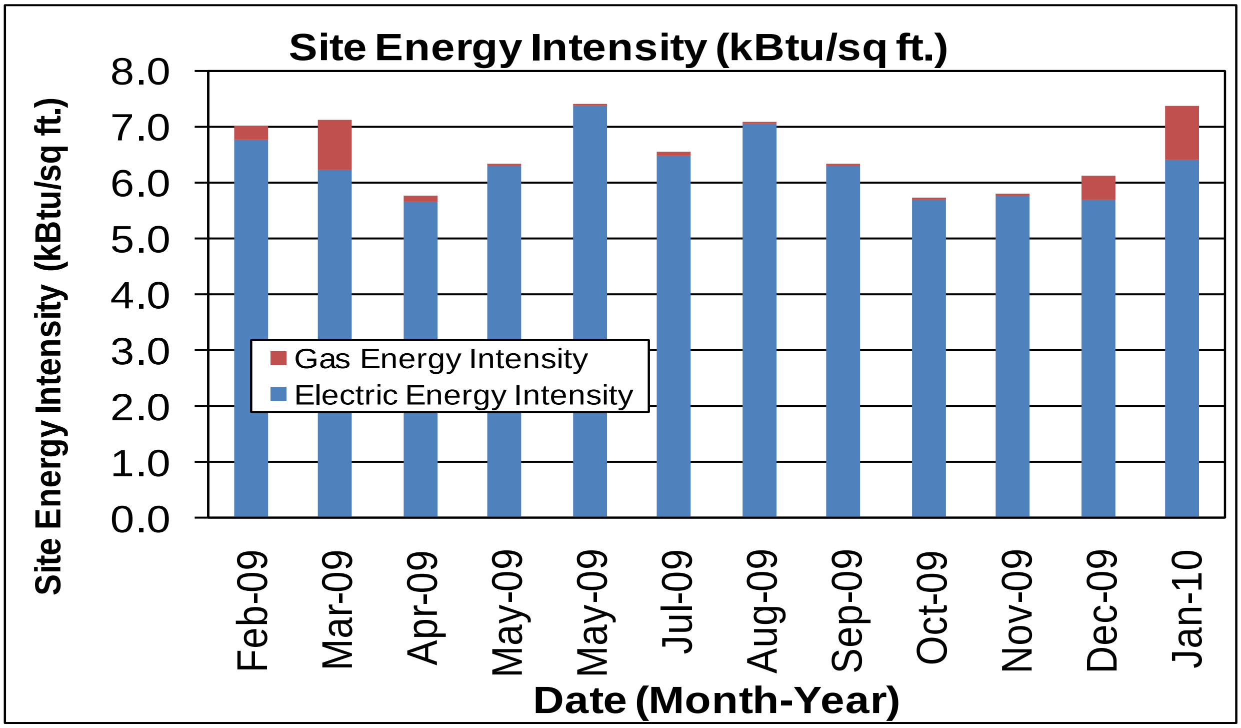




Energy benchmarking

SWA has entered energy information about the Borough Hall in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This mixed use building is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Borough Hall is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is

80.0kBtu/sq ft yr compared to the national average of a borough municipal building consuming 104.0kBtu/sq ft yr. See ECM section for guidance on how to improve the building's rating.



Per the LGEA program requirements, SWA has assisted the Red Bank to create an ENERGY STAR® Portfolio Manager account and share the Borough Hall 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 Red Bank (user name of "boroughofredbank" with a password of "boroughredbank") 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.

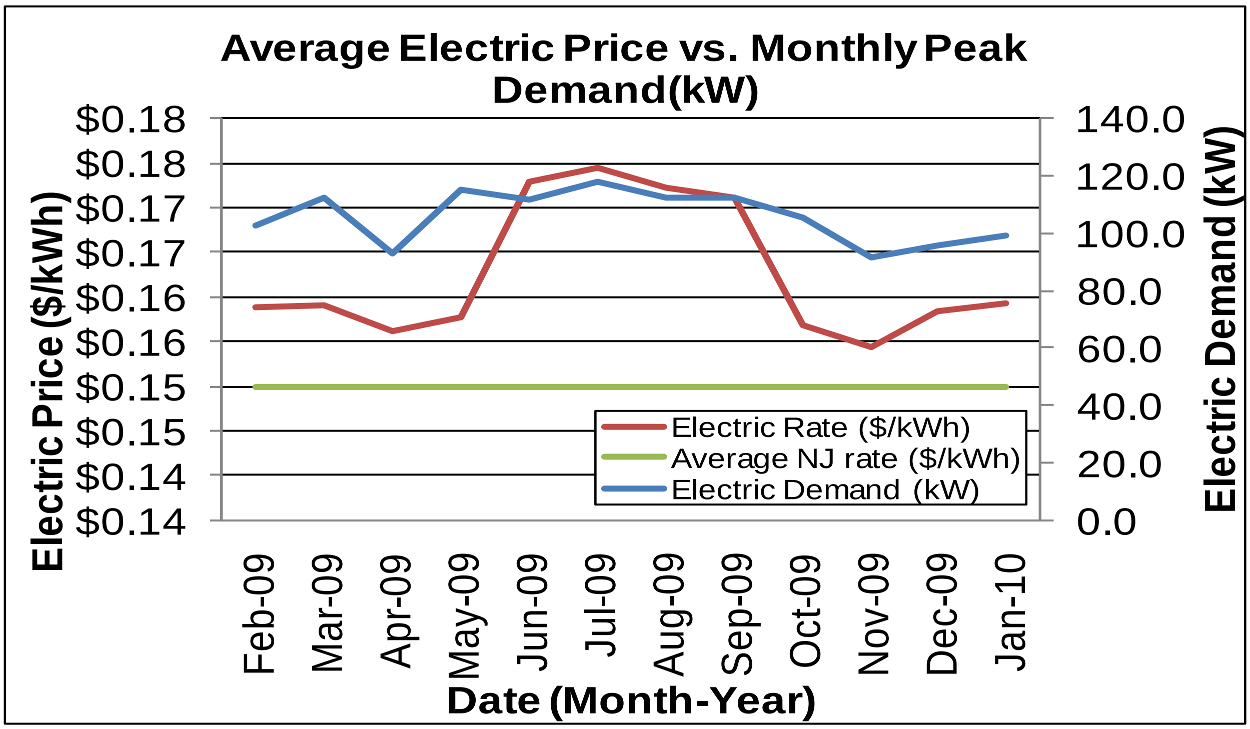
Tariff analysis is performed to determine if the rate that a Red Bank is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by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

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

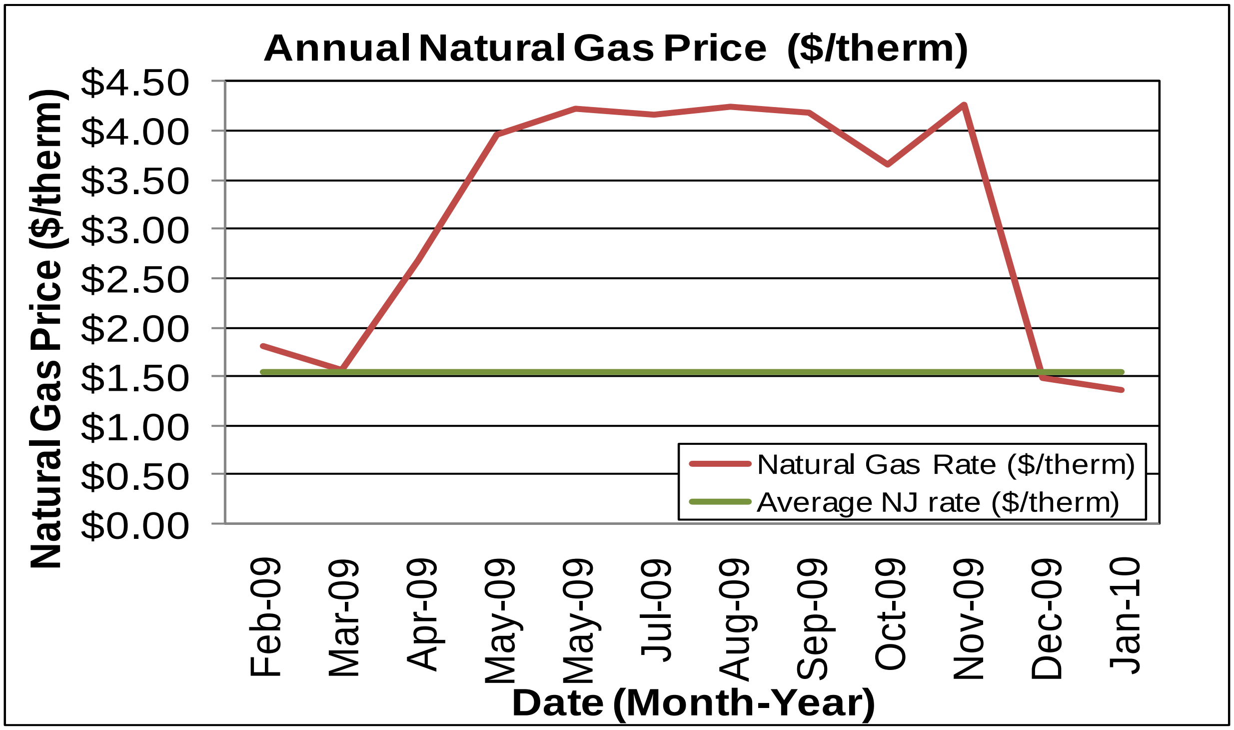
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Borough Hall pays a rate of $0.163/kWh. The Borough Hall annual electric utility costs are $7,181 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 12% over the most recent 12 month period.



The average estimated NJ commercial utility rates for natural gas are $1.550/therm, while Borough Hall pays a rate of $1.775/therm. The Borough Hall annual natural gas utility costs are $166 higher, when compared to the average estimated NJ commercial utility rates. Natural gas bill analysis shows fluctuations up to 68% 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. High gas rates in the summer months are also attributable to low therms usage and fixed meter charges.

SWA recommends that the Borough Hall further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Borough Hall. Appendix C contains a complete list of third-party energy suppliers for the Red Bank service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

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

Based on visits from SWA on Tuesday, June 15, 2010, the following data was collected and analyzed.

Building Characteristics

The four-story, (including two partial basements), 24,751 square foot Red Bank Borough Hall was originally built in 1912 as a car dealership, first two floors were car show rooms, top two floors were offices. The building was renovated to offices in the 1970s. The Borough of Red bank bought the building, renovated it and moved in 1997. It houses a boiler room in a basement, telephone panels, storage and fire pumps in another basement; 4th floor Mayor, Administrator, Municipal Clerk, Fire Chief, Public Information offices and conference room; 3rd floor Fire Marshall, Building Department, Planning and Zoning Department, Code Enforcement offices and a conference room; 2nd floor Vital Statistics, Health Department, Parks and Recreation, RCA Program, Emergency Management, Traffic and Safety/Parking and Detective Bureau offices; 1st floor Water/Sewer - Tax Collector, Finance Department, Tax assessor, Violations Bureau, Court Administrator, Police Department (with jails) offices and a Municipal Court - Council Chamber. The building is sprinkled and maintained above 40 F. The Sally Port sprinklers have antifreeze in the piping.

West Façade and Main Entrance

South Façade

East Façade

North Façade

Building Occupancy Profiles

There are approximately 45 to 55 occupants in the building on weekdays (which could go up to 150 on Court days). Municipal Administration employees work Monday through Friday 8:00am to 5:00pm. The Police Department has 40 officers. The Police Department is located on the 1st floor and part of the 2nd floor. The Police Department occupancy is approximately 13 employees Monday through Friday 8:00am to 5:00pm. There are a mix of shifts with approximately one to five Police Department staff on off-shifts and weekends. Police Dispatch operates 24 hours every day. Court room office hours are Monday through Friday 8:00am to 5:00pm. The Court is in session Thursdays 8:00am to 4:00pm and sometimes Mondays. There are evening meetings in the Court room almost daily (except weekends and holidays) 6:00pm to 10:00pm.

Building Envelope

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

Exterior Walls

The exterior wall envelope is mostly constructed of EIFS (Exterior Insulation Finishing System) with some cornice and dentil accents, over existing masonry walls with R-19 of fiberglass batt cavity insulation. Other lower building areas (bottom 12 ft) are constructed of marble stone veneer panel cladding with some flamed finish accents above large windows, over existing masonry walls with R-19 of fiberglass batt cavity insulation. The interior is mostly painted gypsum wallboard.

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

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

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

Uncontrolled roof water run-off due to missing gutters and downspouts

Missing/ineffectively-applied caulk

Missing/ineffectively-applied caulk

Missing/ineffectively-applied caulk

Uncontrolled roof water run-off due to missing gutters and downspouts

Roof

The building's roofs are predominantly a flat and parapet type over ½" wood fiberboard decking (on top of existing old roof structures), with a dark-colored EPDM single membrane finish. They were replaced in 1997. Five inches of fiberglass batt attic/ceiling insulation, and two inches of polyiso (polyisocyanurate) foam board roof insulation were observed. The roof above the 4th floor was damaged by the last storm and needs to be replaced due to leaks. The 1st floor EPDM roof above Dispatch, Records and Deputy Chief's office has water puddles, leaks and needs to be replaced/repaired. The 1st floor roof between Police department sections has a few valleys and exposed rotted wood that needs fixing/replacement.

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

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

The following specific roof problem spots were identified:

Signs of standing water/pooling

Signs of standing water/pooling

Missing/deteriorating wood trim

Membrane delamination

Rocks/nails or other sharp objects on roof surface

Signs of standing water/pooling

Base

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

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues visible form the exterior only.

The following specific base problem spots were identified:

Water/moisture seepage through joints at the slab

Water/moisture seepage through joints at slab and worsened by cracked downspout connection

Water/moisture seepage through joints at slab and worsened by cracked downspout connection

Windows

The building contains basically two different types of windows.

1. Eighty-two double-hung type windows with insulated aluminum frames clear double glazing (not Low-E) and interior mini blinds. The windows are located throughout the building and were replaced in1997.
2. Twenty-seven fixed type windows with insulated aluminum frames clear double glazing (not Low-E) and interior mini blinds. The windows are located primarily on the first with some on the second floors and were replaced in the 1970s.Twenty-five of the windows are approximately 6ft by 6ft and two in the Police Department area are approximately 6ft by 2ft with an arched top section.

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

The following specific window problem spots were identified:

Exterior doors

The building contains several different types of exterior doors.

1. A number are of glass with aluminum frame and store front system type exterior doors. They are located at the main entrances to the building and were replaced in the 1970s. The main entrance on the west side automatically slides open via detection by motion sensor.
2. A number are painted insulated hollow metal type exterior doors. They are located at different building exits and were replaced in the 1970s.
3. The Sally Port has two metal slats overhead garage doors.

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

Building air-tightness

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

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

Mechanical Systems

Heating Ventilation Air Conditioning

The Red Bank Borough Hall is heated and cooled by a water source heat pump system. The heating is provided by six (6) high efficiency condensing boilers located in the basement boiler room. The cooling tower used for cooling heat rejection is located on grade near the Sally Port, on the north side of the building. The cooling tower basin is showing signs of corrosion with water continuously leaking out on its bottom.

Equipment

Heat Pumps

The building has a system of water source heat pumps that was installed during the 1997 renovation/addition. The seventeen (17) units are either floor-mounted (in a number of janitor/mechanical rooms) or ceiling-mounted (above the drop ceilings) with distribution ductwork. Each water source heat pump contains a combination heating/cooling coil, compressor, blower assembly, damper, filter and controls within a metal cabinet. These units are ducted and draw in air directly from the spaces they serve and mix it with fresh air (controlled by automated dampers), condition the air and discharge it back into the rooms via small supply blowers, distributed ductwork and diffusers. Each unit responds to sensors located in the spaces that it serves and a temperature setting. When the unit is in cooling mode, it uses an internal DX compressor and rejects heat to the building water loop, cooling the room air that is drawn through it by the blower. When the unit is in heating mode, the compressor rejects heat to the room air by operating in the reverse of the cooling mode, extracting heat from the building-wide water loop.

The efficiency of the units is 11.6-15.2 EER, depending on the model installed (see Appendix A for more details). This equipment is in good condition and has approximately 35% of service life left.

Typical water source heat pump and associated cooling water supply/return piping

Boilers

The seventeen (17) Trane heat pumps located throughout the Borough Hall are provided with additional heating hot water by six (6) modular Hydrotherm condensing boilers located in the basement boiler room. The boilers were installed in 1997 and are in good condition. This equipment is about one half of its way through its expected service life of 25 years. The efficiency of this equipment is in excess of 90%. In general, condensing boilers are most efficient when operating at temperatures that are lower than non-condensing or cast iron boilers.

The six Hydrotherm condensing boilers in the boiler room

The Hydrotherm boilers produce heating hot water that is pumped by a pair of floor-mounted Taco pumps also located in the boiler room and further described in the Pump section.

Cooling Tower

The building is cooled by the water source heat pumps mentioned above. Each unit contains a compressor that rejects heat into the overall building water loop when the controls call for cooling.

The heat is rejected from the building water loop via a BAC heat exchanger HX-1 located in the basement boiler room, which is about one half of its way through its expected service life. The cooling tower, associated with the heat exchanger to remove the heat rejected by the heat pumps, is located on grade on the north side of the building. The cooling tower was installed in 1997, and its basin is showing signs of corrosion with water continuously leaking out on its bottom. Water treatment was only introduced four years ago which may have been too late to stop the corrosion damage. SWA recommends replacement with a unit in kind, VFD fan controls and NEMA Premium efficiency motors.

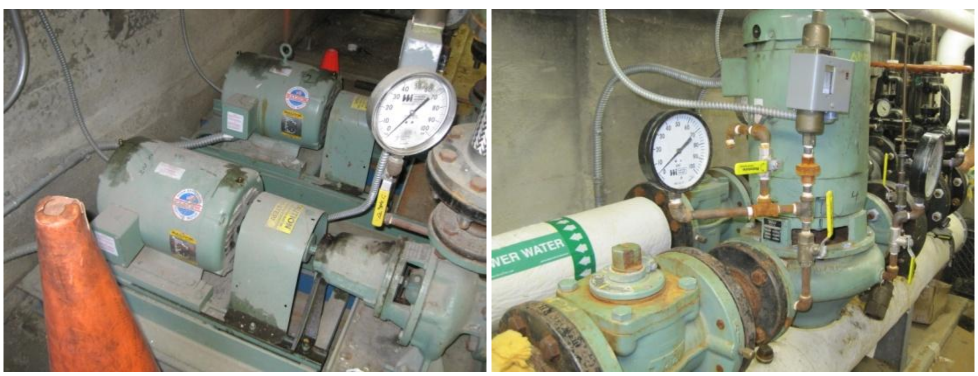
Heat exchanger to remove heat rejected by heat pumps with cooling tower water

Cooling Tower and water leaking to ground from its corroded basin

Pumps

There are a number of fractional horsepower condensate pumps in the building, mostly associated with removing condensate generated by heat pump air cooling. These pumps are in good condition.

System water pumps P-1 and 2 (back-up) are used to provide additional heat (from boilers) and remove rejected heat (via the HX-1 heat exchanger) from the building heat pumps. These Taco pumps are each driven by 15 HP 85.5% efficiency motors and appear in good condition with 25% of expected service lives left. They do not have VFDs.



System water pumps (left); Cooling tower pumps (right)

Cooling tower water pumps P-3 and 4 (back-up) are used to provide cooling to the HX-1 heat exchanger. These Taco pumps are each driven by 7.5 HP 87.5% efficiency motors and appear in good condition with 25% of expected service lives left. They do not have VFDs.

Ventilation

The building has approximately nine exhaust fans and two supply fans driven by fractional horsepower motors, some belt drive, others direct coupled, some on rooftop (mushroom type), others above the ceiling tiles. They appear in good condition with 40% of expected service lives left.

Typical (mushroom) rooftop fans

Small Heaters

There are a number of small heaters in the building used to heat spaces seasonally and keep above freezing, such as electric baseboard heaters with integral thermostats for the staircases and one gas fired heater suspended from the Sappy Port ceiling. In general these heaters appear in good condition with 10% of expected service lives left. With the next major renovation, they should be replaced in kind with the highest energy efficient model available.

Stairwell cabinet and baseboard electric unit heaters

Distribution Systems

A typical heat pump 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 space air is purged and vented outside via separate exhaust fans. The mixed air inside the heat pump is sent through a filter before passing through a combination heating/cooling coil. The heat pump blower then pushes the air through distributed ductwork and diffusers into the building spaces. Each of the seventeen (17) heat pump has its associated ductwork.

Controls

Temperature in rooms is measured via heat sensors and adjusted remotely via a Jersey Controls Building Management System (BMS). In the winter the set point is 72 F with a 68 F setback (after 11:00pm) and in the summer the set point is 68-70 F with a 72 F setback (after 11:00pm). The BMS database includes point names, attributes, descriptors, sequences, set points, schedules and alarm points, to name a few. The BMS has the capability to perform overrides, enthalpy optimizations, calendar scheduling, electric demand limiting functions, optimum starts and stops. It also has trend and maintenance time reminder report capabilities. In discussion with various building occupants, it appears that not all are satisfied with the ambient temperature in the building. SWA recommends re-commissioning (see ECM#7) of the HVAC system to uncover any components which are not performing to design parameters.

Temperature sensor (middle device - typical)

Domestic Hot Water

The domestic hot water (DHW) for the Borough Hall is provided by a number of highly efficient electric heaters, in satisfactory condition however operating beyond their estimated useful lives. Each floor has an A O Smith 10 gallon, 6,000 Watt electric-element DHW heater with the 1st floor having an additional A O Smith 5 gallon, 3000 Watt for providing local sink and bathroom hot water. Separately, there are six (6) under the sink instantaneous inline electric heaters under a few of the sinks on the 1st floor and mainly in the Police Department.

There is a gas fired A O Smith FPS 75 234 heater, with 75,000 Btu/hr, 74.5 gal storage capacity supplying DHW to the Police Department locker rooms and showers. The unit has a 0.53 Energy Factor, appears in satisfactory condition and also operating beyond its estimated useful life.

DHW heaters - One electric per floor (left); Under sink electric type (middle); Gas fired unit serving the locker rooms and showers (right)

Electrical systems

Lighting

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

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

Interior Lighting - The Borough Hall currently contains mainly T8 fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas. There are some concerns with both interior and exterior visibility in a few places.

4 ft 32 Watt T8 lamp (typical - left); 26 Watt CFL pin lamp (typical - right)

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

Typical LED Exit sign - 5 Watt lamp

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of metal halide parking pole lamps and incandescent flood light canopy/soffit fixtures. Exterior lighting is controlled by timers.

Parking lot pole lights and timers controlling entry doors, parking and canopy lights

Appliances and process

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

Elevators

The Borough Hall has one Payton 2,000 lb capacity hydraulic elevator serving four floors, installed in 1977. The hydraulic pump generates 370 psi hydraulic pressure to keep elevator moving. The elevator equipment appears in satisfactory condition.

Other electrical systems

Except for a Kohler 180 kW/225 kVA generator for emergency backup, there are not currently any other significant energy-impacting electrical systems installed at the Borough Hall. The generator appears in satisfactory condition with 35% of expected service life left.

Kohler 180 kW generator

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving, and the cost of installation is decreasing, due to both demand and the availability of state and federal government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

Existing systems

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

Evaluated Systems

Solar Photovoltaic

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

Based on utility analysis and a study of roof conditions, the Borough Hall is a good candidate for a 20 kW Solar Panel installation. See ECM#8 for details.

Solar Thermal Collectors

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

Wind

The Borough Hall may be a potential candidate for wind power generation due to general wind conditions in this area of New Jersey and available roof space. Wind energy can contribute up to 3% of the current annual electric usage based on a 7.5 kW Wind turbine installation. See ECM#4 for details.

Geothermal

The Borough Hall could be a candidate for a geothermal installation. The existing HVAC water cooled heat pump system has major components that have 35% to 50% remaining useful lives. Replacing the cooling tower with a geothermal system would require an estimated investment of $90,000 with estimated annual (heating and cooling) savings of approximately $3,000, realizing a 30 year simple payback.

Combined Heat and Power

The Borough Hall 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. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

PROPOSED ENERGY CONSERVATION MEASURES

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

Recommendations: Energy Conservation Measures

ECM#	Description of Recommended 0-5 Year Payback ECMs
1	Upgrade 12 Incandescent Flood Light Fixtures to CFLs
2	Install 2 Beverage and 2 Snacks Vending Machine Energy Misers in the PD and 4th Floor Lunch Rooms
3	Install VFDs on System Circulator (P-1&2) 15 HP Motors
4	Install 7.5 kW Wind Rooftop System
5	Upgrade One T12 Fixture to a T8 fixture
6	Install 22 Occupancy Sensors
ECM#	**Description of Recommended 5-10 Year Payback ECMs**
7	Retro-commissioning of the HVAC System
8	Install a 20 kW Solar Photovoltaic Rooftop System
9	Upgrade 13 Metal Halide (MH) Fixtures to Pulse Start MH

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

ECM#1: Upgrade 12 Incandescent Flood Light Fixtures to CFLs

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

Installation cost:

Estimated installed cost: $300 (includes $210 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
300	(none at this time)	300	1,388	0.3	0	0.2	70	296	5	1,481	1.0	394	79	95	1,016	2,485

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 2 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#2: Install 2 Beverage and 2 Snacks Vending Machine Energy Misers in the PD and 4th Floor Lunch Rooms

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: $816 (Includes $367 of labor)
Source of cost estimate: Manufacturers information

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
816	none at this time	816	3,980	0.8	0	0.5	0	649	12	7,785	1.3	854	71	79	5,393	7,126

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:

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

Please see Appendix F for more information on Incentive Programs.

ECM#3: Install VFDs on System Circulator (P-1&2) 15 HP Motors

In the United States 50% of the total electrical energy generated is consumed by rotating equipment. 65% of this total is consumed by centrifugal or flow related applications such as fans, blowers, compressors, and pumps according to current estimates. Variable speed (frequency) drive (VFD) technology offers a cost-effective method to match driver speed to load demands and represents a state-of-the-art opportunity to reduce operating costs and improve overall productivity.

Variable frequency drives work by changing the frequency or hertz of the power supplied to the electric motor. This change in frequency causes the electric motor to speed up and slow down depending on the frequency. 60 hertz and the motor is at full speed and generally (depending on drive parameter settings) 15 or lower hertz is low speed. The motor can run anywhere in between the minimum and maximum hertz ranges and will respond with the appropriate speed for the hertz. An important tool for increasing motor system efficiency is the VFD, a device that precisely controls motor speed. In the case of a blower, without VFD to selectively slow the motor, the system is forced to counteract the motor's work after the energy has already been expended, using a baffle or other device to divert air that is already flowing. A VFD, by contrast, responds to the actual need for air flow and adjusts the motor speed accordingly.

The use of VFDs can yield substantial benefits: an estimated 10% energy savings for refrigeration applications, 15% for air compressors, and 20% for pumps and fans. Adding VFDs to HVAC pumps and fans will vary the flow according to the required heating and cooling requirements to better meet the load of the building.

Installation cost:

Estimated installed cost: $6,600 (includes $2,970 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
6,600	none at this time	6,600	16,755	3.2	0	2.3	0	2,731	15	40,967	2.4	521	35	41	24,746	30,001

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit, nameplate data and using the billing analysis. SWA assumed energy savings based on modeling calculator found at http://customer.honeywell.com/Business/Cultures/en-US/Products/Applications+and+Downloads/VFDSoftware.htm and the pumps operating throughout the year.

Rebates/financial incentives:

- There is no incentive available for this measure and this equipment at this time. (Incentives available at this time only for fans, chilled water pumps and rotary screw compressors.)

Please see Appendix F for more information on Incentive Programs.

ECM#4: Install 7.5 kW Wind Rooftop System

Wind power production may be applicable for the Borough Hall location, because of the thermal winds generated in the area. Currently, the Borough Hall does not use any renewable energy systems. Updated renewable energy systems such as “magnetic” vertical axis wind turbines (MVAWT) can be mounted on building roofs offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, 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. Wind systems not only offset the amount of electricity use by a building, but also reduce the building’s electrical demand, resulting in a higher cost savings as well. SWA presents below the economics of installing a 7.5 kW Wind system to offset electrical demand for the building and reduce the annual net electric consumption for the building, however there are insufficient guaranteed incentives for NJ rebates at this time for this investment. The Borough Hall is not eligible for a 30% federal tax credit. The Borough Hall may consider applying for a grant and/or engage a Wind Power generator/leaser who would install the Wind system and then sell the power at a reduced rate.

There are many possible locations for a 7.5kW Wind system installation on top of the building ample roof area. The supplier would need to first determine via recorded analysis at the proposed location(s) consistency and wind speeds available. Area winds of 10 mph will run turbines smoothly and capture the needed power. This is a roof-mounted wind turbine (used for generating electricity) that spins around a vertical axis like a merry-go-round instead of like a windmill, as do more traditional horizontal axis wind turbines (HAWTs). A typical 7.5 kW MVAWT wind system has a 20 ft diameter turbine by 10 ft tall.

The installation of a renewable Wind power generating system could serve as a good educational tool and exhibit for the community. **It is very important that Wind measurements and recordings are taken at the chosen location for at least a couple of months to assure that sufficient wind and speed is available for proper operation and to meet incentive requirements. Also, roof structural support should be checked by a structural engineer to ensure that it is adequate for a Wind System installation.**

Installation cost:

Estimated installed cost: $9,192 (includes $15,000 of labor)
Source of cost estimate: Similar projects

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
60,000	50,808	9,192	15,878	7.5	0	2.2	0	2,588	25	64,701	3.6	604	24	28	33,804	28,429

Assumptions: SWA estimated the cost and savings of the system based on past wind projects. SWA projected physical dimensions based on a 7.5 kW-Enviro Energies turbine system. **SWA assumes that the relatively low height (~43 ft) compared to the taller horizontal axis turbines is acceptable to the NJ BPU as long as the average documented annual wind speed is 11 mph at the hub.**

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive at this time only for vertically spinning high altitude turbines
http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Wind Upfront Incentive Program, Expected performance buy-down (EPBB) is modeled on an annual kWh production of 1-16,000 kWh for a $3.20/kWh upfront incentive level. This 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#5: Upgrade One T12 Fixture to a T8 fixture

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting contains inefficient T12 fluorescent fixtures with magnetic ballasts in the elevator cabin. 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: $210 (includes $127 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
210	15	195	117	0.0	0	0.0	26	45	15	680	4.3	249	17	22	328	209

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 3/4 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install 22 Occupancy Sensors

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via occupancy sensors. SWA identified a number of areas that could benefit from the installation of occupancy sensors. SWA recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a means to control lighting operation. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $4,400 (includes $2,640 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4,840	440	4,400	5,278	1.0	0	0.7	0	860	12	10,324	5.1	135	11	16	3,936	9,450

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

Rebates/financial incentives:

- NJ Clean Energy - Smart Start - Wall-mounted occupancy sensors ($20 per occupancy sensor) - Maximum incentive amount is $440.

Please see Appendix F for more information on Incentive Programs.

ECM#7: Retro-commissioning of the HVAC System

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and/or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems in the building have undergone some renovations in recent years, and some of the occupants continue to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures and (setback) schedules should also be reviewed to identify opportunities for optimizing system performance, besides air balancing and damper proper operation.

Installation cost:

Estimated installed cost: $30,939 (includes $26,298 of labor)
Source of cost estimate: 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
30,939	none at this time	30,939	23,879	4.6	63	3.5	1,820	5,823	12	69,880	5.3	126	10	15	25,524	43,445

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for building heating and cooling. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total building square footage. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

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#8: Install a 20 kW Solar Photovoltaic Rooftop System

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

The size of the system was determined considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation. A PV system could be installed on a portion of the roof with panels facing south. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 20 kW system needs approximately 87 panels which would take up 1,522 square feet.

A PV system would reduce the building's electric load and allow more capacity for surrounding buildings as well as serve as an example of energy efficiency for the community. The building is not eligible for a residential 30% federal tax credit. The building owner may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. Please see below for more information.

Please note that this analysis did not consider the structural capability of the existing building to support the above recommended system. SWA recommends that the Borough of Red Bank 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 of Red Bank should include these costs in the financial analysis of the project.

Installation cost:

Estimated installed cost: $134,000 (includes $53,600 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
150,000	16,000	134,000	23,608	20.0	0	3.3	0	17,648	25	303,203	7.6	126	5	11	91,012	42,270

Cash flow:

cash flow yr 0	cash flow yr 1	cash flow yr 2	cash flow yr 3	cash flow yr 4	cash flow yr 5	cash flow yr 6	cash flow yr 7	cash flow yr 8	cash flow yr 9	cash flow yr 10	cash flow yr 11	cash flow yr 12	cash flow yr 13
-134,000	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648	17,648

cash flow yr 14	cash flow yr 15	cash flow yr 16	cash flow yr 17	cash flow yr 18	cash flow yr 19	cash flow yr 20	cash flow yr 21	cash flow yr 22	cash flow yr 23	cash flow yr 24	cash flow yr 25
17,648	17,648	3,848	3,848	3,848	3,848	3,848	3,848	3,848	3,848	3,848	3,848

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 $16,000 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 $13,800 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#9: Upgrade 13 Metal Halide (MH) Fixtures to Pulse Start MH

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

Installation cost:

Estimated installed cost: $11,375 (includes $6,256 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
11,700	325	11,375	6,868	1.3	0	0.9	160	1,279	15	19,192	8.9	69	5	7	3,567	12,297

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 2 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Smart Start - Pulse Start Metal Halide Fixtures ($25 per fixture)

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Borough Hall:

- 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, both above the 1st floor Dispatch area and 4th floor delaminated sections.

- Replace windows - The windows in the Red Bank Borough Hall were found to be in satisfactory condition. They are typically metal frame double glazed. Replacement of the windows with Low-E type would be a costly capital investment; however, it might reduce annual heating and cooling costs by approximately 2%. This recommendation should be considered with the next major renovation.

- Replace six (6) HP-12 through HP-17 Trane heat pumps serving the 2nd through the 4th floor with higher efficiency models - These six (6) units (approximately 11.6 EER) were installed in 1997. They are in satisfactory condition and have 35% estimated service lives left. They should be considered for replacement in kind with higher efficiency (15.2 EER) units. The more energy efficient replacements will show negligible savings. These replacements cannot be justified by energy savings alone and should be undertaken in the next three to five years as part of a major renovation. The estimated cost of replacement is approximately $30,000 with a simple payback in excess of 40 years.

- Replace ECH-1, 2 & 3, EBB-1 through 5 electric heaters and UH-1 & 2 natural gas fired unit heaters serving stairs, locker rooms and the Sally Port - These were installed in 1997, manufactured by Trane and QMark and appear in satisfactory condition despite having 10% their estimated useful service lives left. Replacement in kind with higher efficiency and improved thermostat temperature control shows negligible savings. These replacements cannot be justified by energy savings alone and should be undertaken in the next three to five years as part of a major renovation. The estimated cost of their replacement is approximately $20,000 with a simple payback in excess of 40 years.

- Install exhaust air heat recovery systems - During the field audit, SWA completed the building HVAC equipment inventory and observed a number of places (such as from bathrooms) where exhaust air is purged from the building. When combining heat recovery equipment with other energy efficient technology, significant energy savings could be achieved. Advantages of these units are up to 90% thermal effectiveness based on counter-flow heat exchange construction and up to 30% latent effectiveness (humidity) during high temperature, high humidity, summer conditions. There will also be no cross contamination due to its non-corrosive monolithic polymer construction as well as the airstreams never coming in direct contact. Additionally, there are no moving or metal parts to promote mechanical failure, and monolithic construction does not permit the growth of mold or mildew. It also allows rehabilitation of existing buildings without extensive HVAC retrofits to meet IAQ standards and permitting requirements, reduces mechanical stress on the existing HVAC systems to allow the equipment to run efficiently with a longer life cycle. Based of the high thermal efficiencies the equipment allows for a reduction in tonnage that is needed to cool the building and because duct work is very costly, the energy savings are insufficient to justify this investment at this time and upgrades should be considered with the next major renovation in the next five to ten years. The estimated cost for installing 8 heat recovery systems and associated ductwork is $80,000 with a simple payback in excess of 40 years.

- Replace Cooling Tower with updated model - During the field audit, SWA inspected the existing cooling tower located next to the building. The expected service life of a cooling tower is 20 years. The tower basin and other components are showing sign of corrosion since water treatment was started only four years ago. SWA recommends replacement of the cooling tower.

  Open cooling towers provide evaporative cooling for many types of systems, and the specific application will largely determine which cooling tower is best suited for a project. Open cooling towers reject heat from water-cooled systems to the atmosphere. Hot water from the system enters the cooling tower and is distributed over the wet deck (heat transfer surface). Air is pulled or pushed through the wet deck, causing a small portion of the water to evaporate. Evaporation removes heat from the remaining water, which is collected in the cold water basin and returned to the system to absorb more heat.

  Rotating air handling components are located on the air inlet face at the base of forced draft towers, facilitating easy access for routine maintenance and service. Additionally, location of these components in the dry entering air stream extends component life by isolating them from the corrosive saturated discharge air. Cooling tower capacities are called out in terms of nominal tons and a flow range at 95F/85F/78F. A nominal cooling tower ton is defined as the capability to cool 3 gpm of water from a 95F entering water temperature to an 85F leaving water temperature at a 78F entering wet-bulb temperature.

  Variable Frequency Drives offer the most precise control of leaving fluid temperature or condensing pressure and the lowest operating cost. VFDs provide compliance with the part load power consumption and speed control requirements in current energy codes, such as ASHRAE 90.1 and California Title 24. In addition, soft-starts, stops and smooth accelerations prolong the life of the mechanical system. Sound is also reduced by minimizing start-up noise and running the tower at the lowest speed necessary to meet the system demand.

  VFD reliability has improved and first costs have come down over the years. This, combined with the system benefits noted above, makes VFDs the most preferred method for controlling evaporative cooling equipment. Fan cycling and two speed motors are used less frequently as a result. SWA recommends VFDs for the new cooling tower fans and continued water treatment, as well as purging and a side slip steam filter.

  The estimated cost for replacing the cooling tower is $24,000 with a simple payback in excess of 40 years.

- Replace one standard efficiency natural gas DHW heater with an ENERGY STAR® condensing model - During the field audit, SWA inspected the existing Locker Room Domestic Hot Water (DHW) heater. There is one standard efficiency heater that produces DHW for the entire year for the Locker Rooms and showers. The water heater utilizes an external storage tank. The expected service life of a DHW heater is 10-13 years. Consideration should be given to replace the existing heater, which is operating beyond its expected service life, with a more efficient type and tank as part of a capital improvement plan.

The most efficient DHW systems available are generally gas-fired. The estimated Energy Factor (a measure of overall efficiency) for the existing heater is 0.53.

The capacity of a water heater is an important consideration. The water heater should provide enough hot water at the busiest time of the day. For a storage water heater, this capacity is indicated by its "first hour rating" (found on Energy Guide label alongside efficiency rating) which accounts for the effects of tank size and the speed by which cold water is heated.

DHW heaters range in size from 20 to 80 gallons (or larger) and fueled by electricity, natural gas, propane, or oil, storage water heaters transfer heat from a burner or coil to water in an insulated tank. Because heat is lost through the flue (except in electric models) and through the walls of the storage tank, energy is consumed even when no hot water is being used.

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

The estimated cost for replacing the DHW heater is $3,450 with a simple payback in excess of 25 years (due to limited use by building occupants).

- Replace five small electric DHW heaters with an ENERGY STAR® natural gas fires condensing models - During the field audit, SWA inspected the existing electric (DHW) heaters on each floor (with two on the 1st floor). Each water heater utilizes an external storage tank (either a 5 or 10 gals). The expected service life of a DHW heater is 10-13 years. Consideration should be given to replace the existing heaters, which are operating beyond their expected service lives, with more efficient natural gas fired condensing type and tanks as part of a capital improvement plan. Also see the similar recommendation above. The estimated cost for replacing the five electric DHW heaters is $10,750 with a simple payback in excess of 40 years (due to limited use by building occupants and need to pipe natural gas to the different floor mechanical areas).

Operations and Maintenance

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

- Inspect and replace cracked/ineffective caulk at façade EIFS joints and at building base.

- Install pan or strip flashing at horizontal EIFS/stucco projections.

- Install/repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.

- Slope roof surface to drain effectively at time of reroofing. Maintain/inspect all roof surfaces on a regular basis. Repair/ patch roof leakage area

- 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/.

- Repair weather-stripping/air-sealing - The exterior doors were inspected and observed to be in satisfactory/age appropriate condition. The weather-stripping is starting to show wear-and-tear allowing air infiltration. SWA recommends resealing these doors with new weather-stripping on all four edges in order to decrease the amount of conditioned air that is lost around each door, checking the weather-stripping at each door regularly, and replacing any broken seals. Tight seals around doors will help to ensure the building is kept continuously insulated. Simply air-sealing the conditioned building envelope can reduce annual heating and cooling costs up to 15%.

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily replace 2.2 gallon per minute (gpm) faucet aerators with 0.5 gallon per minute (gpm) 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 of Red Bank consider 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. Savings of up to 30% in electric usage is possible depending on the performance of the selected ENERGY STAR® appliance.

- 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/

- Perform an HVAC air balance since building spaces have been reconfigured in recent years. This recommendation will ensure that the retro-commissioning estimated savings (per ECM#7) are maintained.

- Change filters in heat pump air handling units monthly to ensure efficient operation of the blower and ensure adequate air delivery to the space.

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

- Inspect heat pump coils for dirt buildup or coil freeze-up every three to six months. These conditions should be rectified if found because they will cause inefficient operation and possibly damage to the equipment.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Red Bank Borough Hall. Based on the requirements of the LGEA program, the Red Bank Borough Hall must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The Red Bank Borough Hall should spend a minimum of $1,778 (or 25% of $7,110) worth of ECMs, net of other NJCEP incentives, to fulfill the obligations.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
DHW	(1) DHW gas fired htr, 75,000 Btu/hr, 74.5 gal storage capacity	A O Smith FPS 75 234, Ser #: MB98-0049716-234	Electric	1st flr janitor closet in Women's locker rm	Men's and Women's locker rooms and showers	1997	0%
DHW	(6) inline sink DHW electrical htr	Control Energy Corp. 46-793214, Ser #: 94 204117	Electric	1st flr under various sinks	1st flr various sinks	1997	0%
DHW	(1) DHW electrical htr, 3,000 Watt htr element	A O Smith Lime Tamer DSE5-3, Ser #: SL95-60467	Electric	1st flr closet	1st flr toilet	1997	0%
DHW	(4) DHW electrical htr, 6,000 Watt htr element	A O Smith Lime Tamer DSE10-6, Ser #: SB97-6643D, -66423, -66427, SL95-60375	Electric	4th , 3rd , 2nd 1st flr janitor mech rm	4th , 3rd , 2nd 1st flr general toilets and sinks	1997	0%
Ventilation	GV-1 supply fan, 1,000 cfm	Trane FUUA180000A 00000, Ser #: A95L46603	Electric	Roof	EF-2 & 3	1997	40%
Ventilation	SF-2 supply fan, 1,330 cfm	Centrx Inliner SX 125 BC	Electric	1st flr South	Men's #155 Rm	1997	40%
Ventilation	SF-1 supply fan, 2,740 cfm, ½ HP	Trane FRFA240R0A6 GD008X, Ser #: A95L46602	Electric	Roof	Police Dept	1997	40%
Ventilation	EF-8 exhaust fan, 150 cfm	Penn DX9B	Electric	above 4th flr, on roof	Toilet	1997	40%
Ventilation	EF-7 exhaust fan, 75 cfm	Penn Z6STD	Electric	above 2nd flr ceiling	PD Lab 206	1997	40%
Ventilation	EF-6 exhaust fan, 150 cfm	Penn Z6HTD	Electric	above 2nd flr ceiling	PD Lab 204	1997	40%
Ventilation	EF-5 exhaust fan, 1,330 cfm	Centrex Inliner SX 105 BC	Electric	1st flr South	Men's #155 Rm	1997	40%
Ventilation	EF-4 exhaust fan, 200 cfm	Penn Z8S-RA	Electric	Basement Boiler Rm	Basement Boiler Rm	1997	40%
Ventilation	EF-3 exhaust fan, 500 cfm	Penn Z102S	Electric	1st flr North	Court Rm	1997	40%
Ventilation	EF-2 exhaust fan, 500 cfm	Penn Z102S	Electric	1st flr North	Court Rm	1997	40%
Ventilation	EF-1 exhaust fan, 2,740 cfm, ½ HP	Trane FCRA20000A6 GA0000, Ser #: A95L46601	Electric	Roof	Police Dept	1997	40%

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Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	ECH-1, 7,500 Watt htr element	Trane F11E004	Electric	Stair 1st flr	Stair	1997	10%
Heating	ECH-2, 5,600 Watt htr element	Trane D34-EO-04	Electric	PD 2nd flr Lab #202	PD 2nd flr Lab #202	1997	10%
Heating	ECH-3, 7,500 Watt htr element	Trane F11E003	Electric	Stair 4th flr	Stair	1997	10%
Heating	EBB-1 & 5, 500 Watt htr elements	QMark CDB508	Electric	Men's and Women's rooms 410 and 411	Men's and Women's rooms 410 and 411	1997	10%
Heating	EBB-4 thru 3, 750 Watt htr elements	QMark CD758	Electric	Stair 2nd, 3rd and 4th flr Stairs	Stairs	1997	10%
Heating	UH-1 unit heater, 30.0 MBH input, 24.9 MBH output, 83% eff	Trane GHND-003	Electric for fan; Natural gas fired	Sally Port	Sally Port	1997	10%
Heating	UH-2 unit heater, 5,000 Watt htr	Trane UHE-C-053AAAA	Electric	Basement Boiler Rm	Basement Boiler Rm	1997	10%
Cooling	(2) P-3 & 4 Cooling Tower pumps, 252 gpm, 7.5 HP, 1,750 rpm	Taco VP3008E2KAB 691D, 87.5% eff Baldor mtr	Electric	Basement Boiler Rm	Borough Hall	1997	25%
Heating	(2) P-1 & 2 System water pumps, 210 gpm, 15 HP, 3,450 rpm	Taco FE2007E2611 E2L0A, 85.5% eff Baldor mtr	Electric	Basement Boiler Rm	Borough Hall	1997	25%
Heating	B-1 thru 6 modular boilers, 150 MBH input each, 792 MBH total output, 90.6% eff	Hydrotherm AM-150, Ser #: 95333 -19R, -17K, -16K, -15K, 01428 -27K, -29K,	Natural gas	Basement Boiler Rm	Borough Hall	1997	50%
Heating - Cooling	HX-1, 210 gpm water flow	BAC HK8-10-2-1C	N/A	Basement Boiler Rm	Borough Hall	1997	50%
Cooling	CT-1, 17,990 cfm air flow, 252 gpm water flow (corroded sections)	BAC VTO-78-KC, Ser #: 051071011	Electric to fans	Outside Sally Port	Borough Hall	1997	0%

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Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date In-stalled	Estimated Remaining Useful Life %
Heating - Cooling	HP-1, 1,600 cfm, 68.5 MBH heating, 56.1 MBH cooling, 15.2 EER	Trane WPHF-057	Electric to comp and blower	1st flr above PD Men's Locker Rm	1st flr PD Fitness and Women's locker rm	1997	35%
Heating - Cooling	HP-2, 1,400 cfm, 55.9 MBH heating, 46.2 MBH cooling, 15.2 EER	Trane WPHF-047	Electric to comp and blower	1st flr above corridor to PD Men's Locker Rm	1st flr PD Conf rm, Chief's office & lunch rm	1997	35%
Heating - Cooling	HP-3, 1,200 cfm, 55.9 MBH heating, 46.2 MBH cooling, 15.2 EER	Trane WPHF-047	Electric to comp and blower	1st flr above PD report writing ceiling area	1st flr PD report writing area, corridor & DWI room	1997	35%
Heating - Cooling	HP-4, 1,200 cfm, 55.9 MBH heating, 46.2 MBH cooling, 15.2 EER	Trane WPHF-047	Electric to comp and blower	1st flr above PD corridor ceiling, next to jail cells	1st flr PD jail cells	1997	35%
Heating - Cooling	HP-5, 1,600 cfm, 68.5 MBH heating, 56.1 MBH cooling, 14.5 EER	Trane WPHF-057	Electric to comp and blower	1st flr above PD main corridor ceiling	1st flr middle sect of Court Rm	1997	35%
Heating - Cooling	HP-6, 1,600 cfm, 74.4 MBH heating, 56.1 MBH cooling, 14.5 EER	Trane WPHF-057	Electric to comp and blower	1st flr above PD compact filing & evidence rm ceiling	1st flr back of Court Rm and Audio – Visual area	1997	35%
Heating - Cooling	HP-7, 1,600 cfm, 74.4 MBH heating, 56.1 MBH cooling, 14.5 EER	Trane WPHF-057	Electric to comp and blower	1st flr above PD compact filing ceiling	1st flr south end PD offices, records rm & corridor	1997	35%
Heating - Cooling	HP-8, 1,000 cfm, 38.4 MBH heating, 48.7 MBH cooling, 14.8 EER	Trane WPHF-040	Electric to comp and blower	1st flr above Muni Court Clerk ceiling	1st flr Muni Court Clerk, Judge's chamber & Court vestibule	1997	35%
Heating - Cooling	HP-9, 1,600 cfm, 68.5 MBH heating, 56.1 MBH cooling, 14.5 EER	Trane WPHF-057	Electric to comp and blower	1st flr above Finance storage files ceiling	1st flr Reception & Finance Dept	1997	35%
Heating - Cooling	HP-10, 1,200 cfm, 55.9 MBH heating, 46.2 MBH cooling, 15.2 EER	Trane WPHF-047	Electric to comp and blower	1st flr above Women's bathroom ceiling	1st flr Financial office, bathroom & corridor	1997	35%
Heating - Cooling	HP-11, 1,200 cfm, 55.9 MBH heating, 46.2 MBH cooling, 15.2 EER	Trane WPHF-047	Electric to comp and blower	1st flr above Violation Clerk ceiling	1st flr Violation Clerk area, vestibule & corridor	1997	35%
Heating - Cooling	HP-12, 1,940 cfm, 68.6 MBH heating, 57.1 MBH cooling, 11.6 EER	Trane WPVE-061	Electric to comp and blower	2nd flr janitor / mech rm	2nd flr north side offices	1997	35%

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Building System	Description, % eff	Model # / Serial #	Fuel	Location	Space Served	Date In-stalled	Estimated Remaining Useful Life %
Heating - Cooling	HP-13, 1,900 cfm, 68.6 MBH heating, 57.1 MBH cooling, 11.6 EER	Trane WPVE-061	Electric to comp and blower	2nd flr mech rm next to elevator	2nd flr offices south of elevator	1997	35%
Heating - Cooling	HP-14, 1,900 cfm, 68.6 MBH heating, 57.1 MBH cooling, 11.6 EER	Trane WPVE-061	Electric to comp and blower	3rd flr janitor / mech rm	3rd flr north side offices	1997	35%
Heating - Cooling	HP-15, 1,900 cfm, 68.6 MBH heating, 57.1 MBH cooling, 11.6 EER	Trane WPVE-061, Ser #: W97A02936	Electric to comp and blower	3rd flr mech rm next to elevator	3rd flr offices south of elevator	1997	35%
Heating - Cooling	HP-16, 1,900 cfm, 68.6 MBH heating, 57.1 MBH cooling, 11.6 EER	Trane WPVE-061	Electric to comp and blower	4th flr janitor / mech rm	4th flr north side offices	1997	35%
Heating - Cooling	HP-17, 3150 cfm, 125.9 MBH heating, 94.0 MBH cooling, 11.8 EER	Trane WPVD-080	Electric to comp and blower	4th flr mech rm next to elevator	4th flr offices south of elevator	1997	35%
Generator	Kohler Power systems 180; 180 kW/225 kVA	180ROZJ81, Ser #: 371008	Electric / Diesel	Next to Cooling Tower and Sally Port	Borough Hall emergency back-up	1997	35%
Lighting	See details - Appendix B	-	Electric	See details - Appendix B	Whole Bldg	1997	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	Corridors 161,2,8	Recessed	E	4'T8	13	4	32	Sw	24	365	5	1,729	15,146	N/A	Recessed	4'T8	E	Sw	13	4	32	24	365	5	1729	15146	0	0	0
2	1	Corridors 161,2,8	Exit Sign	E	LED	4	1	5	N	24	365	1	22	193	N/A	Equipment / Fume Hood	LED	E	N	4	1	5	24	365	1	22	193	0	0	0
3	1	Corridors Cell Block	Recessed	E	4'T8	4	2	32	Sw	24	365	5	276	2,418	N/A	Recessed	4'T8	E	Sw	4	2	32	24	365	5	276	2418	0	0	0
4	1	Processing (104)	Recessed	E	4'T8	2	2	32	Sw	24	365	5	138	1,209	N/A	Recessed	4'T8	E	Sw	2	2	32	24	365	5	138	1209	0	0	0
5	1	DWI (105)	Recessed	E	4'T8	2	2	32	Sw	24	365	5	138	1,209	N/A	Recessed	4'T8	E	Sw	2	2	32	24	365	5	138	1209	0	0	0
6	1	Female Cells (103)	Recessed	E	4'T8	3	2	32	Sw	24	365	5	207	1,813	N/A	Recessed	4'T8	E	Sw	3	2	32	24	365	5	207	1813	0	0	0
7	1	Male Cells (107)	Recessed	E	4'T8	3	2	32	Sw	24	365	5	207	1,813	N/A	Recessed	4'T8	E	Sw	3	2	32	24	365	5	207	1813	0	0	0
8	1	Records	Recessed	E	4'T8	3	4	32	Sw	9	251	5	399	901	C	Recessed	4'T8	E	OS	3	4	32	7	251	5	399	676	0	225	225
9	1	Records Office	Recessed	E	4'T8	2	4	32	Sw	9	251	5	266	601	C	Recessed	4'T8	E	OS	2	4	32	7	251	5	266	451	0	150	150
10	1	Evidence Rm	Recessed	E	4'T8	3	4	32	Sw	9	251	5	399	901	C	Recessed	4'T8	E	OS	3	4	32	7	251	5	399	676	0	225	225
11	1	Dispatch (124)	Recessed	E	4'T8	1	4	32	Sw	24	365	5	133	1,165	C	Recessed	4'T8	E	OS	1	4	32	18	365	5	133	874	0	291	291
12	1	Bathroom (125)	Wall Mounted	E	2'T8	1	2	17	Sw	12	365	2	36	158	N/A	Wall Mounted	2'T8	E	Sw	1	2	17	12	365	2	36	158	0	0	0
13	1	Watch Commander	Recessed	E	4'T8	2	4	32	BL	15	300	5	266	1,197	N/A	Recessed	4'T8	E	BL	2	4	32	15	300	5	266	1197	0	0	0
14	1	Storage Rm	Recessed	E	4'T8	2	4	32	Sw	8	251	5	266	534	C	Recessed	4'T8	E	OS	2	4	32	6	251	5	266	401	0	134	134
15	1	Patrol Comnd Office	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
16	1	Chief & Sec	Recessed	E	4'T8	4	4	32	BL	5	251	5	532	668	N/A	Recessed	4'T8	E	BL	4	4	32	5	251	5	532	668	0	0	0
17	1	Locker Room Genrl (136)	Recessed	E	4'T8	7	4	32	BL	16	365	5	931	5,437	N/A	Recessed	4'T8	E	BL	7	4	32	16	365	5	931	5437	0	0	0
18	1	Locker Room Genrl (136)	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
19	1	Women's Locker Rm (132)	Recessed	E	4'T8	2	4	32	Sw	8	251	5	266	534	C	Recessed	4'T8	E	OS	2	4	32	6	251	5	266	401	0	134	134
20	1	Women's Locker Closet	Recessed	E	4'T8	1	4	32	Sw	8	251	5	133	267	C	Recessed	4'T8	E	OS	1	4	32	6	251	5	133	200	0	67	67
21	1	Men's Locker Rm (135)	Recessed	E	4'T8	2	4	32	Sw	24	365	5	266	2,330	C	Recessed	4'T8	E	OS	2	4	32	18	365	5	266	1748	0	583	583
22	1	Lunch Rm (137)	Recessed	E	4'T8	2	4	32	Sw	16	365	5	266	1,553	C	Recessed	4'T8	E	OS	2	4	32	12	365	5	266	1165	0	388	388
23	1	Train Rm	Recessed	E	4'T8	2	4	32	Sw	9	251	5	266	601	C	Recessed	4'T8	E	OS	2	4	32	7	251	5	266	451	0	150	150
24	1	Sally Port (108)	Recessed	E	4'T8	4	2	32	Sw	3	365	5	276	302	C	Recessed	4'T8	E	OS	4	2	32	2	365	5	276	227	0	76	76
25	1	Court Vestibule (169)	Recessed	E	4'T8	1	4	32	Sw	24	365	5	133	1,165	C	Recessed	4'T8	E	OS	1	4	32	18	365	5	133	874	0	291	291
26	1	Court Rm (101)	Recessed	E	4'T8 U-Shaped	42	2	32	Sw	9	251	5	2,898	6,547	C	Recessed	4'T8 U-Shaped	E	OS	42	2	32	7	251	5	2898	4910	0	1637	1637
27	1	Court Rm (101)	Recessed	S	CFL	12	1	26	Sw	9	251	0	312	705	C	Recessed	CFL	S	OS	12	1	26	7	251	0	312	529	0	176	176
28	1	Court Rm (101)	Exit Sign	E	LED	2	1	5	N	24	365	1	11	96	N/A	Equipment / Fume Hood	LED	E	N	2	1	5	24	365	1	11	96	0	0	0
29	1	Court A/V Closet (102)	Recessed	E	4'T8	1	2	32	Sw	1	251	5	69	17	N/A	Recessed	4'T8	E	Sw	1	2	32	1	251	5	69	17	0	0	0
30	1	Court Conf Rm (111)	Recessed	E	4'T8 U-Shaped	4	2	32	Sw	4	251	5	276	277	C	Recessed	4'T8 U-Shaped	E	OS	4	2	32	3	251	5	276	208	0	69	69
31	Bsmt	Boiler Rm	Recessed	E	4'T8	5	2	32	Sw	1	251	5	345	87	N/A	Recessed	4'T8	E	Sw	5	2	32	1	251	5	345	87	0	0	0
32	Bsmt	Phone/Fire Pmp Rm	Recessed	E	4'T8	11	2	32	Sw	1	251	5	759	191	C	Recessed	4'T8	E	OS	11	2	32	1	251	5	759	143	0	48	48
33	Bsmt	Boiler Rm	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
34	1	Bathroom for Mtg Rm (109)	Wall Mounted	E	2'T8	1	2	17	Sw	4	251	2	36	36	N/A	Wall Mounted	2'T8	E	Sw	1	2	17	4	251	2	36	36	0	0	0
35	1	Foyer to Mtg Rm	Recessed	S	CFL	1	1	26	Sw	2	251	0	26	13	N/A	Recessed	CFL	S	Sw	1	1	26	2	251	0	26	13	0	0	0
36	1	Janitor's Closet (110)	Recessed	S	CFL	1	1	26	Sw	1	251	0	26	7	N/A	Recessed	CFL	S	Sw	1	1	26	1	251	0	26	7	0	0	0
37	Ext	Parking	Pole Mounted	E	MH	6	1	250	T	12	365	70	1,920	8,410	PSMH	Pole Mounted	PSMH	E	T	6	1	150	12	365	30	1080	4730	3679	0	3679
38	Ext	Exit Doors	Wallpack	E	MH	7	1	175	T	12	365	49	1,568	6,868	PSMH	Wallpack	PSMH	E	T	7	1	100	12	365	20	840	3679	3189	0	3189
39	Ext	PD Entrance	Recessed	S	Inc	4	1	75	T	12	365	0	300	1,314	CFL	Recessed	CFL	S	T	4	1	25	12	365	0	100	438	876	0	876
40	Ext	East Entrance	Sconce	E	MH	2	1	250	Sw	1	251	70	640	161	N/A	Sconce	MH	E	Sw	2	1	250	1	251	70	640	161	0	0	0
41	1	Main Vestibule (140)	Recessed	E	4'T8 U-Shaped	4	2	32	Sw	12	251	5	276	831	N/A	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	12	251	5	276	831	0	0	0
42	1	Main Entrance Hall (164)	Exit Sign	E	LED	3	1	5	N	24	365	1	17	145	N/A	Equipment / Fume Hood	LED	E	N	3	1	5	24	365	1	17	145	0	0	0
43	1	Main Vestibule (140)	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
44	1	Main Corridor (140)	Recessed	E	4'T8 U-Shaped	28	2	32	Sw	12	251	5	1,932	5,819	N/A	Recessed	4'T8 U-Shaped	E	Sw	28	2	32	12	251	5	1932	5819	0	0	0
45	1	Street Vestibule (138)	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	12	251	5	138	416	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	12	251	5	138	416	0	0	0
46	1	Street Vestibule (138)	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
47	GF	Elevator	Recessed	M	4'T12	1	4	40	Sw	12	251	12	172	518	T8	Recessed	4'T8	E	Sw	1	4	32	12	251	5	133	401	117	0	117
48	4	Copy Rm	Recessed	E	4'T8	3	4	32	BL	6	251	5	399	601	N/A	Recessed	4'T8	E	BL	3	4	32	6	251	5	399	601	0	0	0
49	4	Copy Rm	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
50	4	Copy Rm	Recessed	E	4'T8 U-Shaped	5	2	32	Sw	8	251	5	345	693	C	Recessed	4'T8 U-Shaped	E	OS	5	2	32	6	251	5	345	520	0	173	173
51	4	Lunch Rm (419)	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	8	251	5	138	277	C	Recessed	4'T8 U-Shaped	E	OS	2	2	32	6	251	5	138	208	0	69	69
52	4	Lunch Rm (419)	Recessed	E	4'T8	4	2	32	Sw	8	251	5	276	554	C	Recessed	4'T8	E	OS	4	2	32	6	251	5	276	416	0	139	139
53	4	Server Rm (421)	Recessed	E	4'T8	2	2	32	Sw	4	251	5	138	139	N/A	Recessed	4'T8	E	Sw	2	2	32	4	251	5	138	139	0	0	0
54	4	Storage Rm (420)	Recessed	E	4'T8	2	4	32	BL	1	251	5	266	67	N/A	Recessed	4'T8	E	BL	2	4	32	1	251	5	266	67	0	0	0
55	4	Storage Rm (422)	Recessed	E	4'T8	2	4	32	BL	1	251	5	266	67	N/A	Recessed	4'T8	E	BL	2	4	32	1	251	5	266	67	0	0	0
56	4	Addn'l Office (423)	Recessed	E	4'T8	2	4	32	BL	6	251	5	266	401	N/A	Recessed	4'T8	E	BL	2	4	32	6	251	5	266	401	0	0	0
57	4	Muni Clerk Office (427)	Recessed	E	4'T8 U-Shaped	4	2	32	BL	5	251	5	276	346	N/A	Recessed	4'T8 U-Shaped	E	BL	4	2	32	5	251	5	276	346	0	0	0
58	4	Deputy Muni Clerk Office (428)	Recessed	E	4'T8 U-Shaped	4	2	32	BL	5	251	5	276	346	N/A	Recessed	4'T8 U-Shaped	E	BL	4	2	32	5	251	5	276	346	0	0	0
59	4	Corridor (418)	Recessed	E	4'T8 U-Shaped	7	2	32	Sw	10	251	5	483	1,212	N/A	Recessed	4'T8 U-Shaped	E	Sw	7	2	32	10	251	5	483	1212	0	0	0
60	4	Corridor (418)	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
61	4	Mech Rm (409)	Recessed	E	4'T8	2	2	32	Sw	2	251	5	138	69	N/A	Recessed	4'T8	E	Sw	2	2	32	2	251	5	138	69	0	0	0
62	4	Bathroom Men (409)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
63	4	Bathroom Women (411)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
64	4	Borough Admin Recept (408)	Recessed	E	4'T8 U-Shaped	6	2	32	BL	5	251	5	414	520	N/A	Recessed	4'T8 U-Shaped	E	BL	6	2	32	5	251	5	414	520	0	0	0
65	4	Conference Rm (402)	Recessed	E	4'T8 U-Shaped	8	2	32	BL	5	251	5	552	693	N/A	Recessed	4'T8 U-Shaped	E	BL	8	2	32	5	251	5	552	693	0	0	0
66	4	Conference Rm (402)	Recessed	S	CFL	4	1	26	Sw	8	251	0	104	209	C	Recessed	CFL	S	OS	4	1	26	6	251	0	104	157	0	52	52
67	4	Admin Office (406)	Recessed	S	Inc	4	1	50	Sw	6	251	0	200	301	CFL	Recessed	CFL	S	Sw	4	1	15	6	251	0	60	90	211	0	211

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)

68	4	Admin Office (406)	Recessed	E	4'T8 U-Shaped	4	2	32	BL	6	251	5	276	416	N/A	Recessed	4'T8 U-Shaped	E	BL	4	2	32	6	251	5	276	416	0	0	0
69	4	Admin Office (406)	Recessed	S	CFL	4	1	26	Sw	6	251	0	104	157	N/A	Recessed	CFL	S	Sw	4	1	26	6	251	0	104	157	0	0	0
70	4	Mayor's Office (401)	Recessed	E	4'T8 U-Shaped	4	2	32	BL	6	251	5	276	416	N/A	Recessed	4'T8 U-Shaped	E	BL	4	2	32	6	251	5	276	416	0	0	0
71	4	Mayor's Office (401)	Recessed	S	CFL	2	1	26	Sw	1	251	0	52	13	N/A	Recessed	CFL	S	Sw	2	1	26	1	251	0	52	13	0	0	0
72	Str	Stairwell-West	Recessed	E	4'T8	6	2	32	Sw	24	365	5	414	3,627	N/A	Recessed	4'T8	E	Sw	6	2	32	24	365	5	414	3627	0	0	0
73	Str	Stairwell-West	Recessed	E	4'T8	2	4	32	Sw	24	365	5	266	2,330	N/A	Recessed	4'T8	E	Sw	2	4	32	24	365	5	266	2330	0	0	0
74	Str	Stairwell-West	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
75	3	Corridor (312)	Recessed	E	4'T8 U-Shaped	8	2	32	Sw	9	251	5	552	1,247	N/A	Recessed	4'T8 U-Shaped	E	Sw	8	2	32	9	251	5	552	1247	0	0	0
76	4	Mech Rm (415)	Recessed	E	4'T8	1	2	32	Sw	1	251	5	69	17	N/A	Recessed	4'T8	E	Sw	1	2	32	1	251	5	69	17	0	0	0
77	3	Mech Rm (315)	Recessed	E	4'T8	1	2	32	Sw	1	251	5	69	17	N/A	Recessed	4'T8	E	Sw	1	2	32	1	251	5	69	17	0	0	0
78	3	Corridor (312)	Exit Sign	E	LED	2	2	5	N	24	365	1	21	184	N/A	Equipment / Fume Hood	LED	E	N	2	2	5	24	365	1	21	184	0	0	0
79	3	Mech Rm (309)	Recessed	E	4'T8	2	2	32	Sw	1	251	5	138	35	N/A	Recessed	4'T8	E	Sw	2	2	32	1	251	5	138	35	0	0	0
80	3	Bathroom Men (310)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
81	3	Bathroom Women (311)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
82	3	Planning & Zoning, 307-8	Recessed	E	4'T8	5	2	32	BL	5	251	5	345	433	N/A	Recessed	4'T8	E	BL	5	2	32	5	251	5	345	433	0	0	0
83	3	Break Rm	Recessed	E	4'T8	3	2	32	Sw	8	251	5	207	416	C	Recessed	4'T8	E	OS	3	2	32	6	251	5	207	312	0	104	104
84	3	Conf Rm (301)	Recessed	E	4'T8	3	2	32	BL	6	251	5	207	312	N/A	Recessed	4'T8	E	BL	3	2	32	6	251	5	207	312	0	0	0
85	3	Conf Rm (301)	Recessed	S	Inc	4	1	75	Sw	6	251	0	300	452	CFL	Recessed	CFL	S	Sw	4	1	25	6	251	0	100	151	301	0	301
86	3	Copy Rm	Recessed	E	4'T8	2	4	32	BL	6	251	5	266	401	N/A	Recessed	4'T8	E	BL	2	4	32	6	251	5	266	401	0	0	0
87	3	Zoning Director	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
88	3	Copy/Storage Rm	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
89	3	Fire Marshall Rm #1	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
90	3	Fire Marshall Rm #2	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
91	3	Bldg Dept Hall (329)	Recessed	E	4'T8 U-Shaped	3	2	32	Sw	10	251	5	207	520	N/A	Recessed	4'T8 U-Shaped	E	Sw	3	2	32	10	251	5	207	520	0	0	0
92	3	Bldg Dept Recept (317)	Recessed	E	4'T8	3	4	32	BL	5	251	5	399	501	N/A	Recessed	4'T8	E	BL	3	4	32	5	251	5	399	501	0	0	0
93	3	Const Office	Recessed	E	4'T8	3	4	32	BL	5	251	5	399	501	N/A	Recessed	4'T8	E	BL	3	4	32	5	251	5	399	501	0	0	0
94	3	Plan & Review	Recessed	E	4'T8	3	4	32	BL	5	251	5	399	501	N/A	Recessed	4'T8	E	BL	3	4	32	5	251	5	399	501	0	0	0
95	3	Drwg Files	Recessed	E	4'T8	4	4	32	BL	5	251	5	532	668	N/A	Recessed	4'T8	E	BL	4	4	32	5	251	5	532	668	0	0	0
96	3	Storage Rm	Recessed	E	4'T8	3	4	32	BL	2	251	5	399	200	N/A	Recessed	4'T8	E	BL	3	4	32	2	251	5	399	200	0	0	0
97	Str	Stairwell - East	Recessed	E	4'T8	7	2	32	Sw	24	365	5	483	4,231	N/A	Recessed	4'T8	E	Sw	7	2	32	24	365	5	483	4231	0	0	0
98	Str	Stairwell - East	Exit Sign	E	LED	1	1	5	N	24	365	1	6	48	N/A	Equipment / Fume Hood	LED	E	N	1	1	5	24	365	1	6	48	0	0	0
99	2	Corridor (213)	Recessed	E	4'T8 U-Shaped	10	2	32	Sw	9	251	5	690	1,559	N/A	Recessed	4'T8 U-Shaped	E	Sw	10	2	32	9	251	5	690	1559	0	0	0
100	2	Vital Stats Reception	Recessed	E	4'T8	4	4	32	BL	5	251	5	532	668	N/A	Recessed	4'T8	E	BL	4	4	32	5	251	5	532	668	0	0	0
101	2	Vital Stats Storage	Recessed	E	4'T8	1	2	32	Sw	8	251	5	69	139	N/A	Recessed	4'T8	E	Sw	1	2	32	8	251	5	69	139	0	0	0
102	2	Registrar's Office	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
103	2	Registrar's Storage	Recessed	E	4'T8	2	4	32	BL	3	251	5	266	200	N/A	Recessed	4'T8	E	BL	2	4	32	3	251	5	266	200	0	0	0
104	2	Neighborhood Preserve	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
105	2	Tax Assessor	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
106	2	Tax Assessor Storage	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
107	2	Parks and Rec	Recessed	E	4'T8	4	4	32	BL	5	251	5	532	668	N/A	Recessed	4'T8	E	BL	4	4	32	5	251	5	532	668	0	0	0
108	2	Mech/Filter Rm (210)	Recessed	E	4'T8	2	2	32	Sw	1	251	5	138	35	N/A	Recessed	4'T8	E	Sw	2	2	32	1	251	5	138	35	0	0	0
109	2	Mech Rm (216)	Recessed	E	4'T8	1	2	32	Sw	1	251	5	69	17	N/A	Recessed	4'T8	E	Sw	1	2	32	1	251	5	69	17	0	0	0
110	2	Bathroom Women (212)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
111	2	Bathroom Men (211)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
112	2	Criminal Invst Recept (209)	Recessed	E	4'T8	2	4	32	BL	6	251	5	266	401	N/A	Recessed	4'T8	E	BL	2	4	32	6	251	5	266	401	0	0	0
113	2	Juvenille Rm (208)	Recessed	E	4'T8	2	4	32	BL	24	251	5	266	1,602	N/A	Recessed	4'T8	E	BL	2	4	32	24	251	5	266	1602	0	0	0
114	2	Bathroom (206)	Wall Mounted	E	2'T8	1	2	17	Sw	4	251	2	36	36	N/A	Wall Mounted	2'T8	E	Sw	1	2	17	4	251	2	36	36	0	0	0
115	2	PD Cubicles (203)	Recessed	E	4'T8	6	4	32	BL	8	365	5	798	2,330	N/A	Recessed	4'T8	E	BL	6	4	32	8	365	5	798	2330	0	0	0
116	2	PD Cubicles	Recessed	E	4'T8 U-Shaped	7	2	32	BL	8	365	5	483	1,410	N/A	Recessed	4'T8 U-Shaped	E	BL	7	2	32	8	365	5	483	1410	0	0	0
117	2	Interview Rm (204)	Recessed	E	4'T8	1	4	32	Sw	8	251	5	133	267	N/A	Recessed	4'T8	E	Sw	1	4	32	8	251	5	133	267	0	0	0
118	2	Lab (202)	Recessed	E	4'T8	1	4	32	Sw	8	365	5	133	388	C	Recessed	4'T8	E	OS	1	4	32	6	365	5	133	291	0	97	97
119	2	Commander's Office (201)	Recessed	E	4'T8	2	4	32	BL	8	365	5	266	777	N/A	Recessed	4'T8	E	BL	2	4	32	8	365	5	266	777	0	0	0
120	1	Judge's Office (141)	Recessed	E	4'T8	2	4	32	Sw	2	251	5	266	134	N/A	Recessed	4'T8	E	Sw	2	4	32	2	251	5	266	134	0	0	0
121	1	Muni Court Clerk (143)	Recessed	E	4'T8	4	4	32	BL	5	251	5	532	668	N/A	Recessed	4'T8	E	BL	4	4	32	5	251	5	532	668	0	0	0
122	1	Bathroom - Court (145)	Wall Mounted	E	2'T8	1	2	17	Sw	4	251	2	36	36	N/A	Wall Mounted	2'T8	E	Sw	1	2	17	4	251	2	36	36	0	0	0
123	1	Storage	Recessed	E	4'T8	1	4	32	Sw	4	251	5	133	134	N/A	Recessed	4'T8	E	Sw	1	4	32	4	251	5	133	134	0	0	0
124	1	Elevator Mech Rm (146)	Recessed	E	4'T8	1	2	32	Sw	2	251	5	69	35	N/A	Recessed	4'T8	E	Sw	1	2	32	2	251	5	69	35	0	0	0
125	1	Finance	Recessed	E	4'T8	2	4	32	BL	5	251	5	266	334	N/A	Recessed	4'T8	E	BL	2	4	32	5	251	5	266	334	0	0	0
126	1	Finance Sec (150)	Recessed	E	4'T8 U-Shaped	4	2	32	Sw	8	251	5	276	554	N/A	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	251	5	276	554	0	0	0
127	1	Tax Collector Recept (151)	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	8	251	5	138	277	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	8	251	5	138	277	0	0	0
128	1	File Storage (152)	Recessed	E	4'T8	2	2	32	Sw	6	251	5	138	208	N/A	Recessed	4'T8	E	Sw	2	2	32	6	251	5	138	208	0	0	0
129	1	Tax Dept (153)	Recessed	E	4'T8	8	4	32	Sw	8	251	5	1,064	2,137	N/A	Recessed	4'T8	E	Sw	8	4	32	8	251	5	1064	2137	0	0	0
130	1	CFO (154)	Recessed	E	4'T8	2	4	32	BL	9	251	5	266	601	N/A	Recessed	4'T8	E	BL	2	4	32	9	251	5	266	601	0	0	0
131	1	Bathroom Women (157)	Recessed	E	4'T8	3	2	32	OSCM	4	251	5	207	208	N/A	Recessed	4'T8	E	OSCM	3	2	32	4	251	5	207	208	0	0	0
132	1	Bathroom Men (155)	Recessed	E	4'T8	2	2	32	OSCM	4	251	5	138	139	N/A	Recessed	4'T8	E	OSCM	2	2	32	4	251	5	138	139	0	0	0
133	1	Janitor's Closet (156)	Recessed	S	CFL	1	1	26	Sw	1	251	0	26	7	N/A	Recessed	CFL	S	Sw	1	1	26	1	251	0	26	7	0	0	0
134	1	Violations Bureau (159)	Recessed	E	4'T8	6	4	32	BL	6	251	5	798	1,202	N/A	Recessed	4'T8	E	BL	6	4	32	6	251	5	798	1202	0	0	0
		Totals:				**472**	**348**	**4,553**				**735**	**42,485**	**120,046**						**472**	**348**	**4,235**			**659**	**40,338**	**106,395**	**8,373**	**5,278**	**13,651**

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

Proposed Lighting Summary Table			
Total Surface Area (SF)	24,751		
Average Power Cost ($/kWh)	0.1630		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	16,752	9,008	**7,744**
Exterior Power (watts)	4,428	2,660	**1,768**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	103,294	97,387	**5,907**
Lighting Power (watts)	38,057	37,678	**379**
Lighting Power Density (watts/SF)	1.54	1.52	**0.02**
Estimated Cost of Fixture Replacement ($)	11,675		
Estimated Cost of Controls Improvements ($)	4,400		
Total Consumption Annual Cost Savings ($)	**2,847**		

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

JCP&L ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com

NJ NATURAL GAS CO. NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6-BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Gateway Energy Services Corp.** 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com
UGI Energy Services, Inc. d/b/a/ GASMARK 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com	**Hess Energy, Inc.** One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**MxEnergy, Inc.** 510 Thornall Street, Suite 270Edison, NJ 08837 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024 866-568-0290 www.NewJerseyGasElectric.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm	**Sprague Energy Corp.** 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

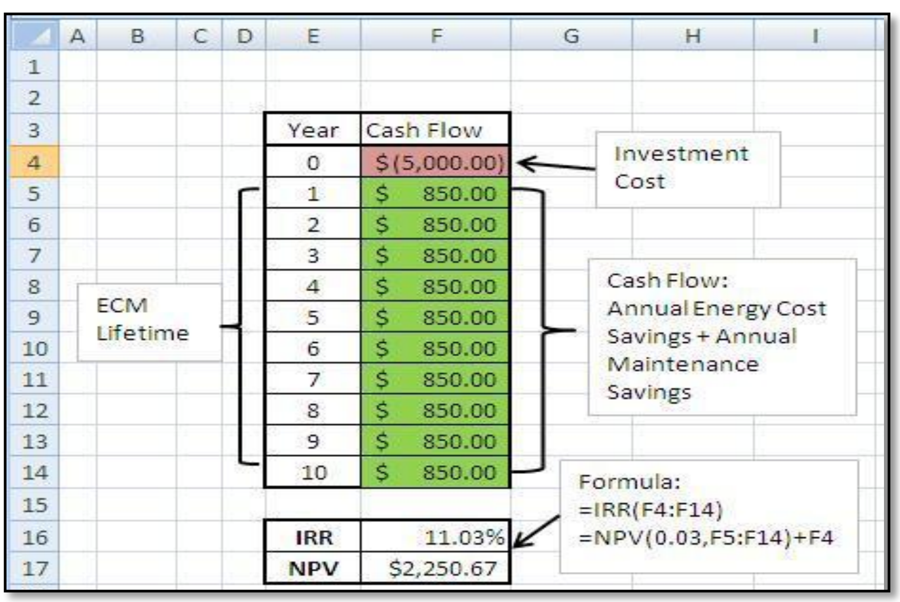
Calculation References

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

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

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

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of Redbank - Borough Hall

Building ID: 2218147
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 24, 2010

Facility
Borough of Redbank - Borough Hall
90 Monmouth Street
Red Bank, NJ 07701

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1912
Gross Floor Area (ft²): 24,751

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,869,230
Natural Gas (kBtu)[4]	116,481
Total Energy (kBtu)	1,985,711
Energy Intensity[5]	
Site (kBtu/ft²/yr)	80
Source (kBtu/ft²/yr)	257
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	291
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	21%
Building Type	Other

Stamp of Certifying Professional

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

Meets Industry Standards[6] for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, 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.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

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

Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program*

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

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

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

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

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

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

Other Federal and State Sponsored Programs

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

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

APPENDIX G: ENERGY CONSERVATION MEASURES

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 12 incandescent flood light fixtures to CFLs	300	(none at this time)	300	1,388	0.3	0	0.2	70	296	5	1,481	1.0	394	79	95	1,016	2,485
2	Install 2 beverage and 2 Snacks vending machine energy misers in the PD and 4th floor lunch rooms	816	none at this time	816	3,980	0.8	0	0.5	0	649	12	7,785	1.3	854	71	79	5,393	7,126
3	Install VFDs on system circulator (P-1&2) 15 HP motors	6,600	none at this time	6,600	16,755	3.2	0	2.3	0	2,731	15	40,967	2.4	521	35	41	24,746	30,001
4	install 7.5 kW Wind rooftop system (with $3.20/kWh upfront incentive))	60,000	50,808	9,192	15,878	7.5	0	2.2	0	2,588	25	64,701	3.6	604	24	28	33,804	28,429
5	Upgrade one T12 fixture to a T8 fixture	210	15	195	117	0.0	0	0.0	26	45	15	680	4.3	249	17	22	328	209
6	Install 22 occupancy sensors	4,840	440	4,400	5,278	1.0	0	0.7	0	860	12	10,324	5.1	135	11	16	3,936	9,450
	Totals	**72,766**	**51,263**	**21,503**	**43,396**	**12.8**	**0**	**6.0**	**96**	**7,170**	**-**	**125,938**	**3.0**	**486**	**-**	**33**	**69,223**	**77,700**

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
7	Retro-commission ing		30,939	none at this time	30,939	23,879	4.6	63	3.5	1,820	5,823	12	69,880	5.3	126	10	15	25,524	43,445
8	Install 20 kW PV with Incentives		150,000	20,000	130,000	23,608	20.0	0	3.3	0	17,648	25	303,203	7.4	133	5	11	94,887	42,270
9	Upgrade 13 Metal Halide (MH) fixtures to pulse start MH		11,700	325	11,375	6,868	1.3	0	0.9	160	1,279	15	19,192	8.9	69	5	7	3,567	12,297
	Totals		**Totals**		**192,639**	**20,325**	**172,314**	**54,355**	**25.9**	**63**	**7.7**	**1,980**	**24,751**	**-**	**392,275**	**7.0**	**128**	**-**	**12**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

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

Disclaimer

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

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