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July 9, 2010

Local Government Energy Program
Energy Audit Draft Report

City of Northfield
Municipal Building
1600 Shore Road
Northfield, New Jersey 08225

Project Number: LGEA71

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EXECUTIVE SUMMARY

The Northfield Municipal Building is a single-story building with a partial basement comprising a total conditioned floor area of 14,346 square feet. The original structure was built in 1969 with renovations/additions in 1974 and 1994. The following chart provides an overview of current energy usage in the building based on the analysis period of April 2009 through March 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	230,080	9,180	N/A	50,159	119.0	1,703
Proposed	134,473	5,850	N/A	30,086	73.0	1,044
Savings	95,607*	3,330	N/A	20,073	46.0	660
% Savings	42%	36%	N/A	40%	39%	39%

*Includes 59,020 kWh savings from a proposed 50 kW PV Renewable System

There may be energy procurement opportunities for the Northfield Municipal Building to reduce annual utility costs, which are $1,418 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Municipal Building in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This mixed use facility is comprised of non-eligible ("Other") space type. and there is no rating available at this time. The Site Energy Use Intensity is 119.0kBtu/sq ft yr compared to the national average of a mixed use building consuming 104.0kBtu/ sq ft yr. See ECM section for guidance on how to improve the building's rating.

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	9,304	3.6	33,477	56,560
5-10 Year	51,356	7.6	392,726	151,326
Total	60,661	7.0	426,203	207,886

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 17 cars from the roads each year or avoiding the need of 506 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 heating terminal units
    - Replace the standard efficiency gas fired DHW heater with a condensing type
    - Replace four (4) electric baseboard heaters in the Police Department
    - Replace storage, bathroom and engine bay exhaust fans

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    - Replace heating hot water circulators
- Operations and Maintenance
    - Insure that heating hot water circulator controls are working properly
    - Thoroughly and evenly insulate space above the drop ceiling tiles
    - Air balance distributed conditioned air - for uniform and steady temperature
    - Provide weather-stripping/air-sealing
    - Insulate any un-insulated hot piping throughout the building

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the City of Northfield. Based on the requirements of the LGEA program, the City of Northfield must commit to implementing some of these measures and submit paperwork to the LGEA program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $2,088.

Financial Incentives and Other Program Opportunities

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

Table 3: Next Steps for the Municipal Building

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Upgrade 35 thermostats to programmable type	N/A
8 New LED exit sign fixtures to be installed with incentives	SmartStart, Direct Install
6 New occupancy sensors to be installed with incentives	SmartStart, Direct Install
10 New CFL fixtures to be installed with incentives	N/A
8 New pulse start metal halide fixtures to be installed with incentives	SmartStart, Direct Install

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

- **New Jersey Clean Energy Pay for Performance** - Three phase incentive plan:

1. Develop plan to reduce current energy use by 15%: receive up to 50% of annual energy costs
2. Install measures per plan: receive up to $0.13 per kWh saved and $1.45 per therm saved
3. Benchmark energy savings for a year: receive up to $0.09/kWh saved & $1.05/therm.

- **Direct Install 2010 Program**: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.
- **Smart Start**: Majority of energy saving equipment and design measures have moderate incentives under this program.
- **Renewable Energy Incentive Program**: Receive up to $0.8/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.
- **Utility Sponsored Programs**: Look for available programs with Atlantic City Electric and South Jersey Gas Co.
- **Energy Efficiency and Conservation Block Grant Rebate Program**: Provides up to $20,000 per local government toward energy saving measures.

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 Municipal Building at 1600 Shore Road. The process of the audit included facility visits on May 13 and June 1, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the City of Northfield to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the City of Northfield.

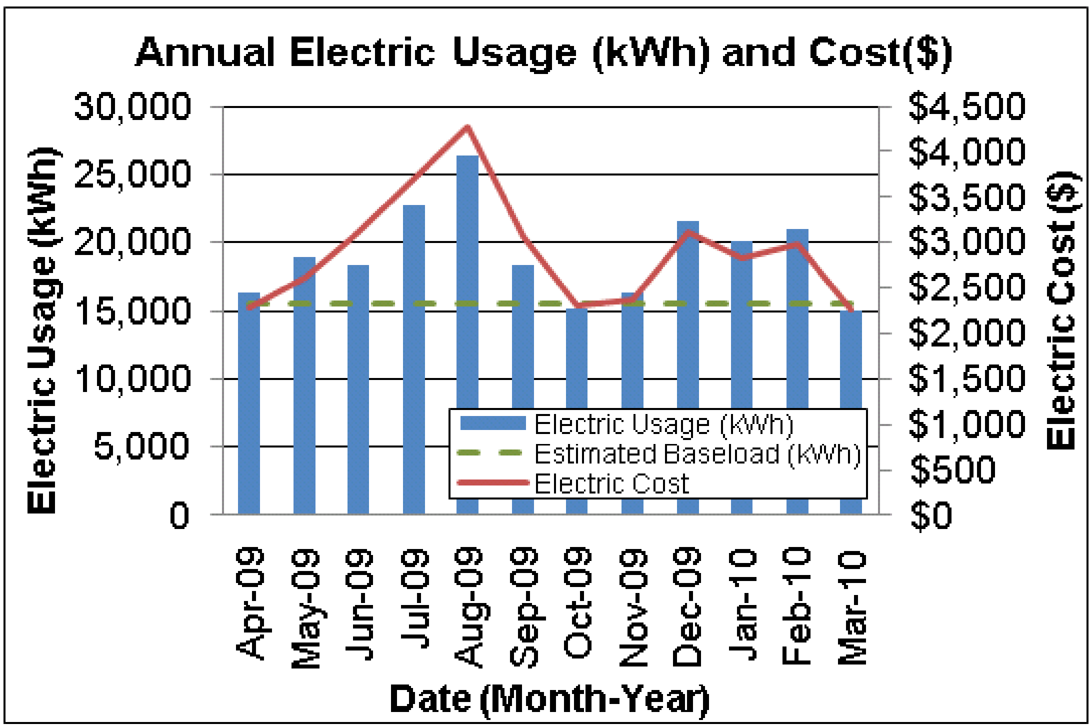
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

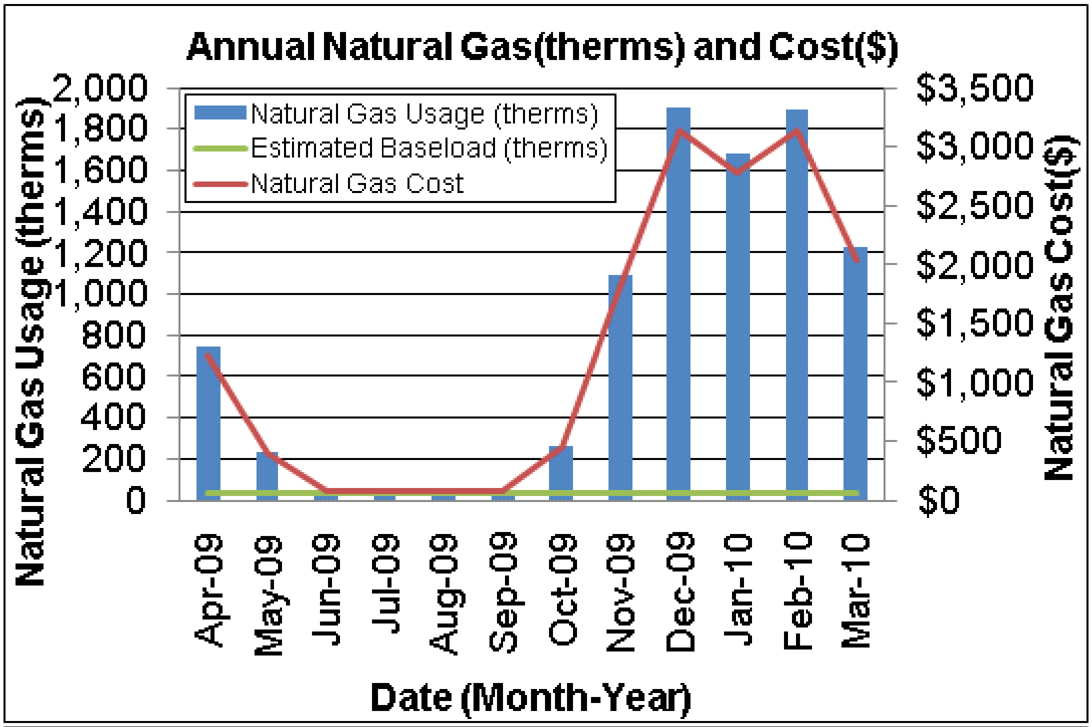
Electricity - The Northfield Municipal Building is currently served by one electric meter. The Northfield Municipal Building currently buys electricity from Atlantic City Electric at **an average aggregated rate of $0.152/kWh**. The Northfield Municipal Building purchased **approximately 230,080 kWh, or $34,884 worth of electricity,** in the previous year. The average monthly demand was 48.0 kW and the annual peak demand was 56.0 kW.

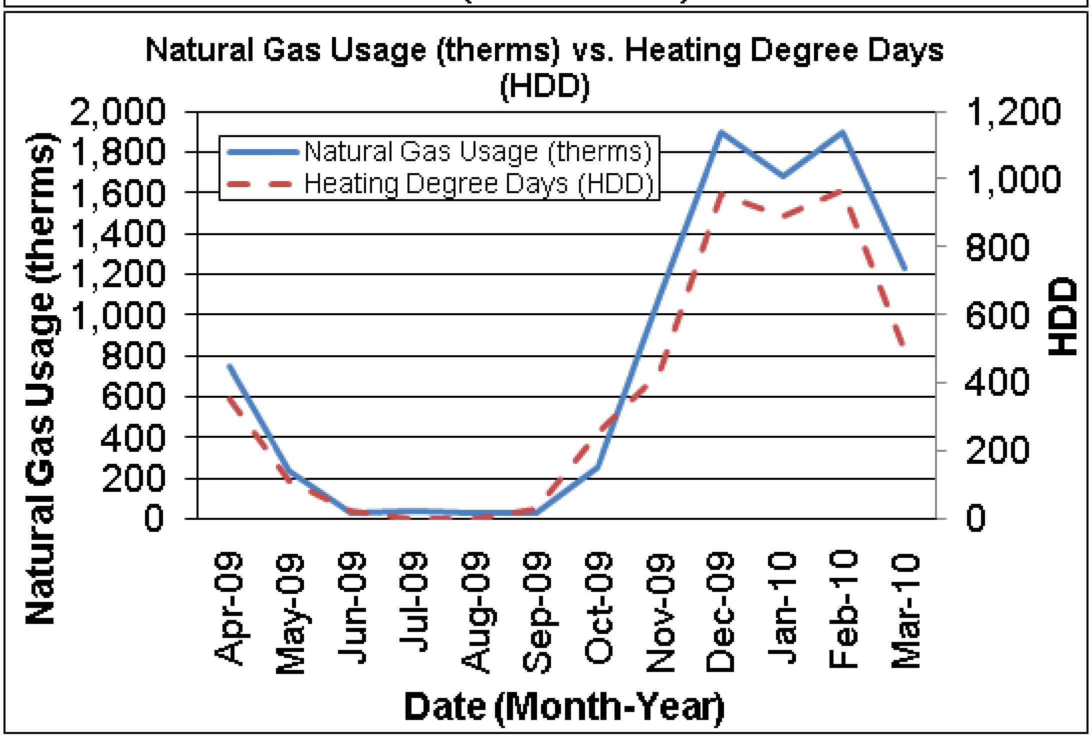
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Northfield Municipal Building.



Natural gas - The Northfield Municipal Building is currently served by one meter for natural gas. The Northfield Municipal Building currently buys natural gas from South Jersey Gas Co. at **an average aggregated rate of $1.664/therm**. The Northfield Municipal Building purchased **approximately 9,180 therms, or $15,275 worth of natural gas,** in the previous year.

The following chart shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the Northfield Municipal Building.

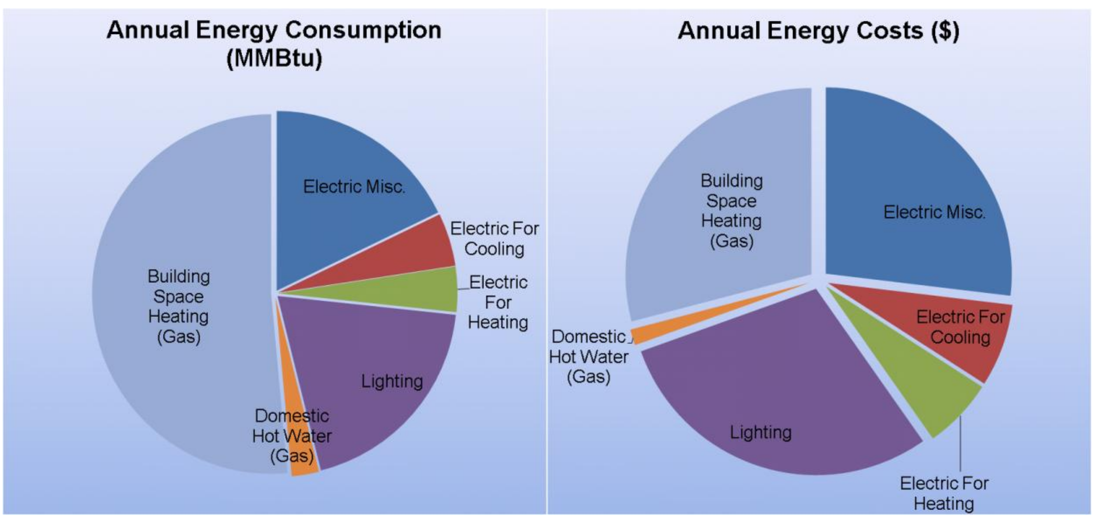




The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the Municipal Building based on utility bills for the 12 month period. Note: electrical cost at $44/MMBtu of energy is almost three times as expensive as natural gas at $17/MMBtu

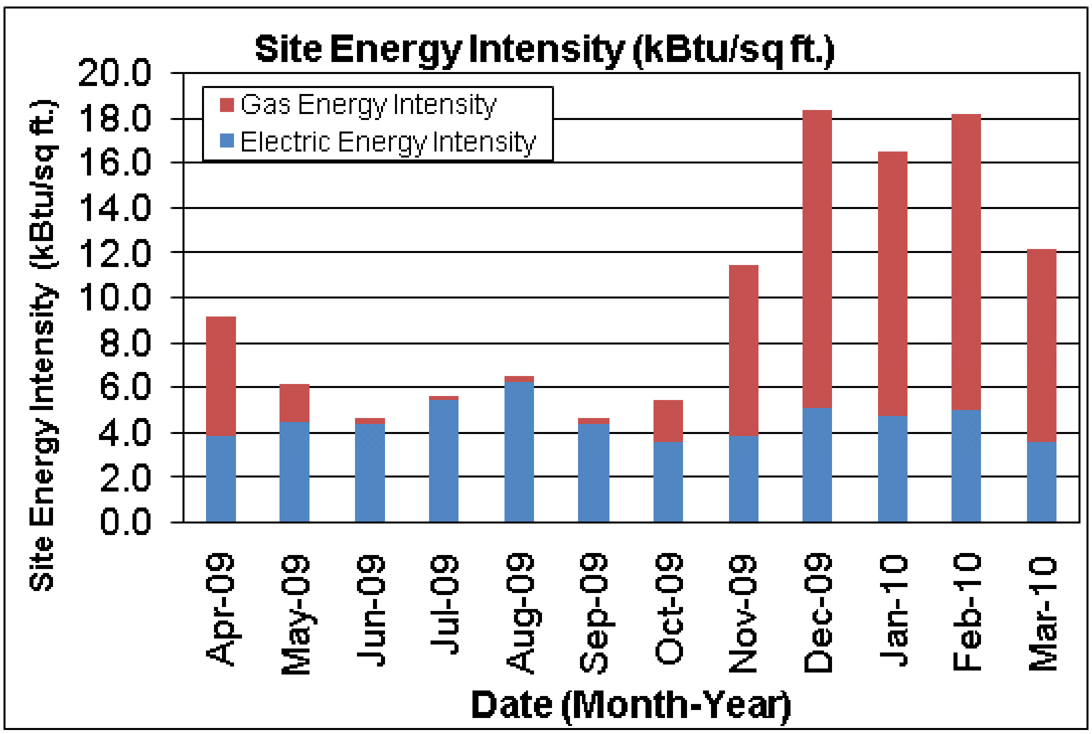
Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	304	18%	$13,487	27%	44
Electric For Cooling	81	5%	$3,613	7%	44
Electric For Heating	69	4%	$3,083	6%	44
Lighting	331	19%	$14,702	29%	44
Domestic Hot Water (Gas)	42	2%	$696	1%	17
Building Space Heating	876	51%	$14,579	29%	17
Totals	1,703	100%	$50,159	100%	
Total Electric Usage	785	46%	$34,884	70%	44
Total Gas Usage	918	54%	$15,275	30%	17
Totals	1,703	100%	$50,159	100%	



Energy benchmarking

SWA has entered energy information about the Northfield Municipal Building in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This mixed use facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the Northfield Municipal Building is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 119.0kBtu/sq ft yr compared to the national average of a mixed use building consuming 104.0kBtu/sq ft yr. See ECM section for guidance on how to improve the building's rating.

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



Per the LGEA program requirements, SWA has assisted the City of Northfield to create an ENERGY STAR® Portfolio Manager account and share the Northfield Municipal Building 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 Municipality (user name of "cityofnorthfield" with a password of "cityofnorthfield") 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.

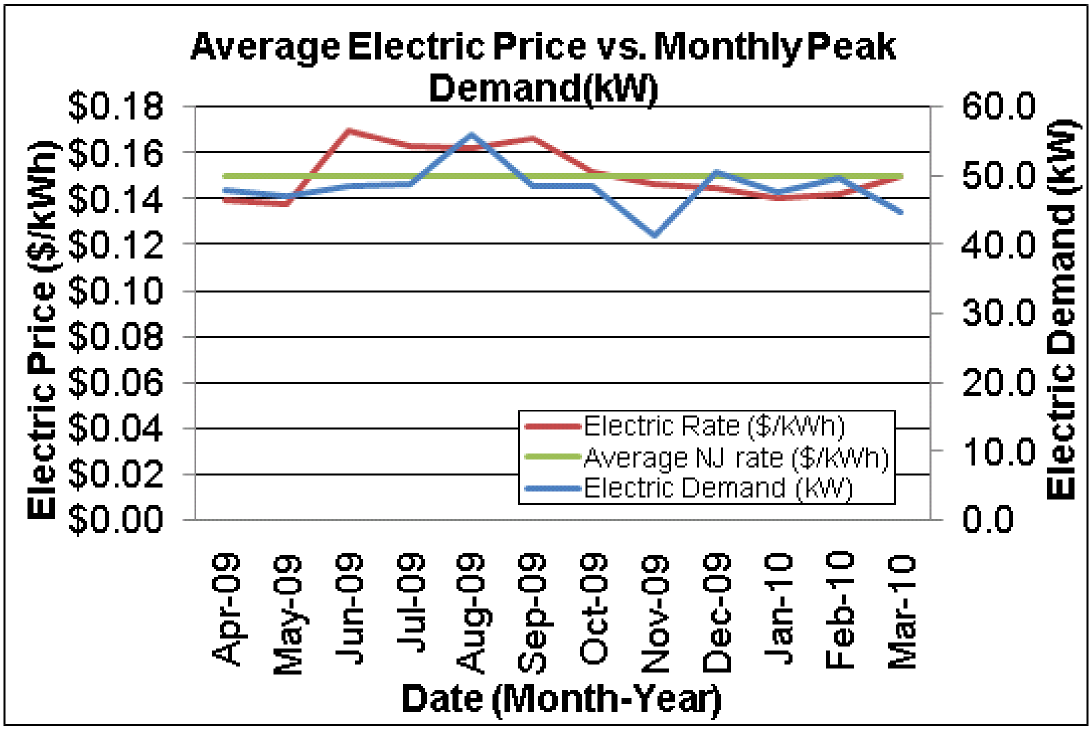
Tariff analysis is performed to determine if the rate that a municipality is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used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

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

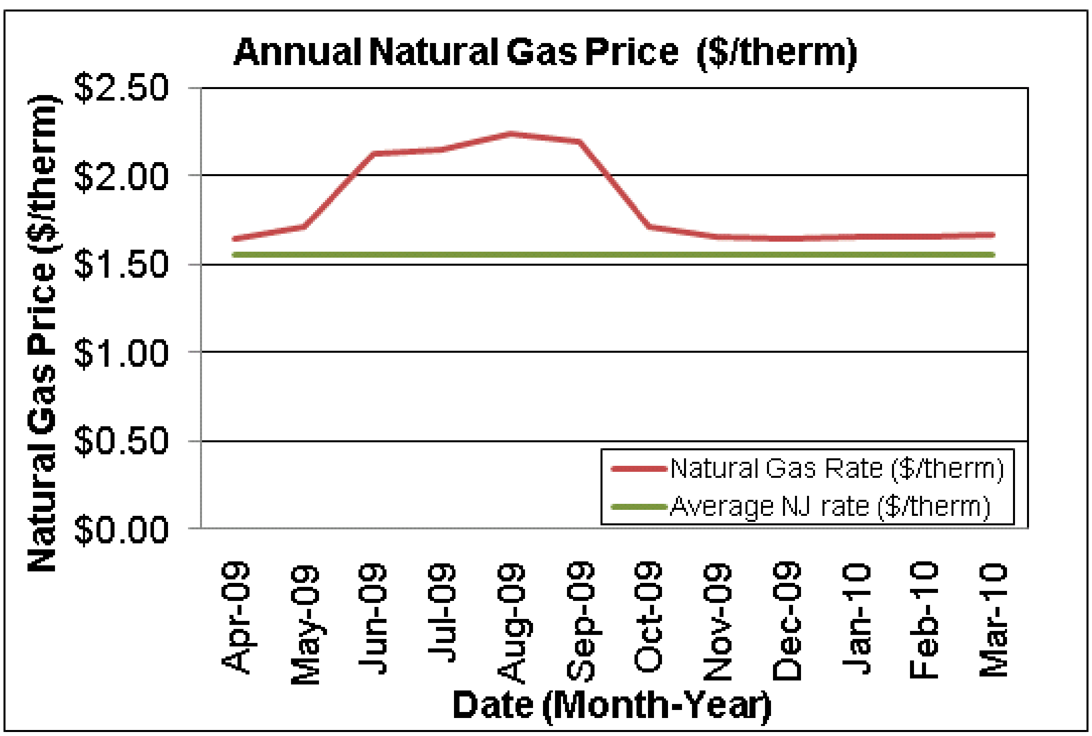
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Northfield Municipal Building pays a rate of $0.152/kWh. The Northfield Municipal Building annual electric utility costs are $372 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 19% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while the Northfield Municipal Building pays a rate of $1.664/therm. The Northfield Municipal Building annual natural gas utility costs are $1,046 higher, when compared to the average estimated NJ commercial utility rates. Natural gas bill analysis shows fluctuations up to 26% over the most recent 12 month period.



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

SWA recommends that the Northfield Municipal Building 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 Northfield Municipal Building. Appendix C contains a complete list of third-party energy suppliers for the City of Northfield 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 01, 2010, the following data was collected and analyzed.

Building Characteristics

The single story, slab below grade including a partial basement, 14,346 square foot Municipal Building was originally constructed in 1969. It houses the City Clerk, Court/Council Chambers, the Police Department, the Fire Department, Tax/Planning/Zoning offices and various other administrative municipal offices; the basement level houses a Boiler room, the Construction Office, the Zoning Office, the Rescue Squad Office, the Emergency Management Office and storage areas.


Partial North Façade


Partial West Façade


Partial South Façade


Partial East Façade

Building Occupancy Profiles

The building's occupancy is approximately 20 employees daily on weekdays from 8:30 AM - 4:30 PM. There is a varying amount of visitors to the municipal offices portion of the building. The Police and Fire Departments operate all day every day. The Police Department occupancy is eight employees, 12 hour shifts; two to three employees are in and out on the night shift and weekends. Police Dispatch is shared and located in Linwood, NJ. The Fire Department has six paid employees and a number of volunteers working 12 hour shifts. Court is held three days a month. The City Council and the Planning Board meet twice a month each.

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 brick veneer over concrete block with 1-1/2 inches of assumed insulation. Other areas are constructed of painted CMU (Concrete Masonry Unit) and some with 1-1/2 inches of assumed insulation. The interior is mostly painted gypsum wallboard and painted CMU (Concrete Masonry Unit).

Note: Wall insulation levels could not be verified in the field and are based on available construction plans.

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

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

Efflorescence on brick and masonry walls indicate moisture presence within the wall cavity. Cracked/aged caulk and signs of shifted brick.

Roof

The building's roof is predominantly flat, no parapet type over steel decking, with a built-up asphalt finish and gravel ballast. It was replaced approximately 10-15 years ago. Two and a half inches of foam board roof insulation, were recorded. Other parts of the building are also covered by a medium-pitch gable type over a wood structure, with an asphalt shingle finish. These roofs were also replaced 10-15 years ago. Four inches of fiberglass batt attic/ceiling insulation, were recorded.

Note: Roof insulation levels could not be verified in the field, and are based on available construction plans.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following are typical building roof surfaces:

Typical roof surfaces

Base

The building's base is composed of a slab-on-grade and slab below grade floor with a perimeter footing with poured concrete foundation walls 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 at time of construction.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains basically three different types of windows:

1. Double-hung type windows with an insulated aluminum frames, clear double glazing and interior mini blinds. The windows are located throughout the building.
2. Fixed type windows with an insulated aluminum frame, tinted double glazing and no interior or exterior shading devices. The windows are located on the basement floor.
3. Hopper type windows with an insulated aluminum frames, clear double glazing and no interior or exterior shading devices. The windows are located on the basement floor. Some of these windows are equipped with exterior fence guards.

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

The following specific window problem spots were identified:

Damaged/aged window frame and air-leakage at sleeved window/wall air-conditioning units, exterior water damage signs on areas around windows

Exterior doors

The building contains three different types of exterior doors.

1. Overhead type paneled metal exterior doors. They are located in the Fire Department garage bay.
2. Solid metal type exterior doors. They are located throughout the building.
3. Wood type paneled metal exterior doors. They are located throughout the building

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

The following specific door problem spots were identified:

Typical exterior doors with missing/worn weather-stripping around metal doors and cracked caulk and damaged frame around some wood doors.

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 building is generally divided into three sections: the center Municipal offices, the Fire Department to the left and the Police Department to the right. An original cast iron boiler located in the basement Boiler room of the building center section provides heating hot water via circulators to various baseboard heating coils, radiators, heating cabinets and hydronic ceiling hung units (in the Fire Department engine bays). The building is primarily air conditioned by a number of Air Handling (AH) units located in the attic space above the drop ceiling of the various spaces served. Each AH has a cooling direct expansion (DX) evaporator coil. A number of rooftop condensers (one each for the Fire Department, Council Chamber, Jail/Processing area, City Hall foyer and the Court office) located on top of the Court room roof, cool and compress the refrigerant in the loop. The R-22 refrigerant absorbs heat from the passing air in the AH evaporator coil and transfers the heat to the atmosphere in the rooftop condenser. The distribution ductwork is several zones, per each AH, tied to local thermostats (some programmable however most are manual) for temperature control. In general, the thermostats are functioning satisfactorily.

There are a number of electric baseboard heaters in the Police Department (PD) four administrative offices, as well as a heat pump for the same four offices and the Clerk's office which provides the heating/cooling. Two mini split ductless air conditioners and two window/through-the-wall AC units augment cooling in the basement Inspection office, Court room office and Tax office. During the winter there are at least five electric portable heaters used under various desks. Ventilation is provided by the AH units as well as four wall mounted exhaust fans primarily for the basement storage areas and eight fractional horsepower rooftop exhaust fans serving the building bathrooms, storage areas, engine bays and generator enclosure.

Equipment

Heating hot water is provided to the building by a cast iron Weil-McLain boiler sized for 1,320,000 Btu/hr input with a 1,056,000 Btu/hr output capacity, estimated to be 80% thermally efficient. It is original to the building, in satisfactory condition and operating beyond its expected service life. Two B&G, 1/4 horsepower circulators (also operating beyond their expected service lives) distribute boiler hot water to building baseboard heating coils, radiators (such as the perimeter hydronic coils in the Fire Department engine bays), heating cabinets and hydronic ceiling hung units (in the Fire Department engine bays). One B&G pump was observed during the field audit to operate constantly even though the building did not call for heating. The boiler is also controlled by a Honeywell Aquatrol unit which resets and proportions the hot water temperature according to outdoor temperature for energy conservation. The boiler does not have a vent damper to prevent heat from escaping in-between heating cycles.



Weil-McLain boiler and B&G circulator pump

Original Modine heating cabinets can be found throughout the building. They each contain a hot water heating coil with manual knobs for heat/temperature adjustment. A fan takes room air and blows it across the heating coil back into the room. Original Modine hydronic ceiling hung units are used to heat the Fire Department engine bays. All the Modine equipment was installed in 1969 and is operating beyond its expected service lives. Separately, the Police Department four administrative offices are heated by electric baseboard heating units.



Fire Department hydronic ceiling hung units; Modine heating cabinets (typical in building)

Additionally, four administrative Police Department offices and the City Clerk's office is also heated/cooled by a heat pump which has the condenser portion on the Court rooftop and the air handler above the drop ceiling. This 2.5 ton system has an estimated SEER (Btu/hr-Watt) of 10 and operating beyond its expected service life. The City of Northfield should consider replacement to updated high efficiency SEER 14 system using R410A environmentally friendly refrigerant. A heat pump is a device that uses a small amount of energy to move heat from one location to another. Heat pumps are usually used to pull heat out of the air to heat a space, or they can be switched into reverse to cool a space. Heat pumps and air conditioners operate in very similar ways.

There are several split air conditioning systems serving the building. There are two mini split ductless Sanyo systems cooling the Inspection office (with 60% of service life left) and the Court Office (which is operating beyond its expected service life) with an estimated SEER of 10. Newer high efficiency units are available with a SEER of 14.

The Fire Department office and meeting room are cooled by a 1-1/2 ton Trane rooftop packaged air conditioner with 60% of service life left. This Trane/American Standard TCC018F100B model is a single packaged central air conditioner. Its efficiency rating of 10 SEER (9.4 EER) makes it a mid-efficiency model.

There are two window/through-the-wall AC units, one in the Tax office, the other in the Court room office with 60-75% of service lives left, of estimated 9.7 EER which augment space air conditioning in those spaces.

The City Hall foyer, Council Chamber, Jail area/PD Processing area and the Court office are each cooled by Carrier and Trane split systems with condensers on the roof of the Court room and the air handlers above the drop ceiling of spaces they service. They were installed in 2006 and have 75% of service lives left. The City Hall foyer unit is also a heat pump. Please see Appendix A: Equipment inventory for the SEER efficiencies of each unit.


Police Department rooftop heat pump condenser; Fire Department rooftop packaged AC

The building has a number of fractional horsepower exhausts air fans operating beyond their expected service lives. Four ½ HP wall mounted exhaust fans ventilate the basement storage areas. Another eight rooftop mushroom type exhaust fans ventilate bathrooms, storage areas, engine bays and generator enclosure.


Basement exhaust fans for storage areas; Rooftop fans for Fire Dept. engine bays

Distribution Systems

A typical AH unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through distribution header, ducts and diffusers into the building spaces. The system blower may operate to provide fresh air to the building In-between seasons. The AH units are equipped with motorized outdoor air dampers however the fresh air quantities should be confirmed and adjusted if necessary to meet code.

Controls

Each system, zone is controlled by its own thermostat. Most thermostats are manual, except for a few programmable types in such spaces as the Court room, Inspection and Court offices. It appeared that even the programmable thermostats were manually operated and setbacks not fully optimized. The Modine heating cabinets have very rough heating settings which control area temperatures poorly. They are seldom adjusted because accessibility is difficult.


Court room programmable thermostat; Fire Dept. manual thermostat (typical)

Modine cabinet heater with missing knobs for heat adjustment (typical)

The under the desk portable heaters used in the winter by multiple employees is a sign that the heat distribution is not optimized.

Domestic Hot Water

There is one (1) 50-gallon Bradford White Defender Hydrojet domestic hot water (DHW) heater (with an estimated Energy Factor of 0.62) located in basement Boiler room which serves hot water to the entire building. It was installed in 2006 and has 65% expected service life left. The distribution piping should be insulated wherever it can be accessed to insure delivery of hot water readily to the farthest parts of the building. The City of Northfield should consider replacing this unit with a gas fired condensing type DHW heater of approximately 95% efficiency when the present heater has reached the end of its life cycle of approximately 12 years.

DHW heater located in the basement Boiler room

Electrical systems

Lighting

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

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

Interior Lighting - The Northfield Municipal Building currently contains fixtures with mostly inefficient T12 magnetically ballasted lamps, however, there were some with electronically ballasted T8 fixtures. There are also some fixtures with incandescent, CFL (Compact Fluorescent Lightbulb) and halogen lamps as well. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Exit Lights - Exit signs were found to be fluorescent and incandescent type.

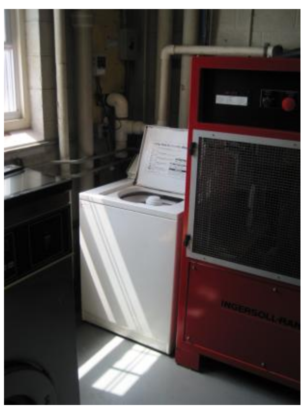
Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of metal halide lamp, high pressure sodium and CFL fixtures. Exterior lighting is controlled by switches and photocells.

Appliances and process

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

Eight refrigerators were inspected throughout the building. All of them are older models non-ENERGY STAR® units that should be replaced in kind with ENERGY STAR® labeled units. Of the eight inspected, six are large full size residential refrigerators and two are compact models.

There are two washing machines and one dryer located in the Fire Department. One of the washing machines is manufactured by Whirlpool while the other is manufactured by Raytheon under the name of UniMac for their UnitMat25 series. This unit’s model number is UC25PN2YU20001. The dryer is gas fired, manufactured by Maytag and is model number PYG2200AWW.




Existing laundry units: Whirlpool washing machine (left) and Maytag dryer and UnitMat25 washing machine (right)

Elevators

The Northfield Municipal Building does not have an installed elevator.

Other electrical systems

Except for a Kohler 39 kW/49 kVA generator for emergency backup, there are not currently any other significant energy-impacting electrical systems installed at the Northfield Municipal Building.

Kohler 39 kW/49 kVA emergency generator

The Fire Department has an Ingersoll-Rand instrument air compressor that is operated approximately 15 times annually to fill cylinders with pressurized air. It is in good condition and has an estimated 10 years of service life left.

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 Northfield Municipal Building is a good candidate for a 50 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.

Geothermal

The Northfield Municipal Building is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have between 25% - 75% remaining useful lives.

Combined Heat and Power

The Northfield Municipal Building is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical 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 Space Temperature Control with Programmable Thermostats
2	Install Eight (8) New LED Exit Signs
3	Install Six (6) New Occupancy Sensors
4	Install Ten (10) New CFL Fixtures
5	Install Eight (8) New Pulse Start Metal Halide Fixtures
6	Retro-commissioning the HVAC System
ECM#	Description of Recommended 5-10 Year Payback ECMs
7	Install One Hundred and Fifty-Three (153) New T8 Fluorescent Fixtures
8	Install a 50 kW Solar Photovoltaic Rooftop System
9	Replace Old Police Department Heat Pump with Energy Star Efficient Type
10	Replace Two (2) Large Refrigerators with 17 cu. ft. ENERGY STAR® Models
11	Replace Six (6) Compact Refrigerators with 2.7 cu. ft. ENERGY STAR® Models
12	Install Two New ENERGY STAR® Label Washing Machines
13	Replace Old Boiler with an Energy Star Efficient Condensing Model

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

ECM#1: Upgrade Space Temperature Control with Programmable Thermostats

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

SWA recommends that besides replacing (approximately 10) existing manual wall thermostats, programmable thermostats also be tied in and installed on (approximately 25) cabinet heaters.

Installation cost:

Estimated installed cost: $8,750 (includes $3,938 of labor)
Source of cost estimate: RS Means; Published and established costs; Similar projects

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8,750	none at this time	8,750	4,416	0.9	876	7.2	1,167	3,296	12	39,551	2.7	352	29	37	22,935	17,565

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA also assumed an aggregated 40 min/wk to make manual adjustments vs. an installed programmable thermostat. SWA assumed that temperatures would be setback based on the operation schedule of the building and used Energy Star site: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TH , Excel spreadsheet for Savings Calculator.

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#2: Install Eight (8) New LED Exit Signs

On the days of the site visits, SWA completed a lighting inventory of the City of Northfield Municipal Building (see Appendix B). The municipal complex currently contains 8 fluorescent and incandescent exit signs. SWA recommends replacing these exit signs with newer, more efficient LED models. Exit signs present a good opportunity for savings since they are operated 24 hours per day.

Installation cost:

Estimated installed cost: $921 (includes $432 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
1,081	160	921	1,730	0.4	0	0.4	64	327	15	4,911	2.8	433%	29%	35	2,932	3,098

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

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – LED Exit Signs ($20 per fixture) - Maximum incentive amount is $160.

Please see Appendix F for more information on Incentive Programs

ECM#3: Install Six (6) New Occupancy Sensors

On the days of the site visits, SWA completed a lighting inventory of the City of Northfield Municipal Building (see Appendix B). The building contains six areas that could benefit from the installation of occupancy sensors. These areas consisted of various offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced micro-phonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $1,200 (includes $528 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
1,320	120	1,200	2,088	0.4	0	0.5	0	317	15	4,760	3.8	297%	20%	26	2,534	3,738

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

Rebates/financial incentives:

- NJ Clean Energy - SmartStart - Wall-mounted Occupancy Sensors ($20 per control) - Maximum incentive amount is $120.

Please see Appendix F for more information on Incentive Programs

ECM#4: Install Ten (10) New CFL Fixtures

On the day of the site visit, SWA completed a lighting inventory of the City of Northfield Municipal Building (see Appendix B). The existing lighting inventory contained a total of 10 inefficient incandescent and halogen lamps. SWA recommends that each incandescent and halogen lamp is replaced with a more efficient, Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power.

Installation cost:

Estimated installed cost: $404 (includes $282 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
404	none at this time	404	613	0.1	0	0.1	12	105	5	527	3.8	31%	6%	10	76	1,097

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs

ECM#5: Install Eight (8) New Pulse Start Metal Halide Fixtures

On the day of the site visit, SWA completed a lighting inventory of the City of Northfield Municipal Building (see Appendix B). The existing lighting inventory contained eight fixtures with inefficient metal halide and high pressure sodium lamps. SWA recommends replacing them with more efficient, Pulse Start Metal Halide fixtures with electronic ballasts. Pulse Start Metal Halide fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to metal halide or high pressure sodium fixtures.

Installation cost:

Estimated installed cost: $4,270 (includes $1,788 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
4,470	200	4,270	6,202	1.3	0	1.5	163	1,106	15	16,586	3.9	288%	19%	25	8,741	11,105

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) - Maximum incentive amount is $200.

Please see Appendix F for more information on Incentive Programs

ECM#6: Retro-commissioning 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 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: $17,933 (includes $15,243 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
17,933	none at this time	17,933	5,752	1.2	876	7.5	1,820	4,152	12	49,828	4.3	178	15	21	22,200	19,958

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#7: Install One Hundred and Fifty-Three (153) New T8 Fluorescent Fixtures

On the day of the site visit, SWA completed a lighting inventory of the City of Northfield Municipal Building (see Appendix B). The existing lighting inventory contained one hundred and fifty-three inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to a T12 fixture with magnetic ballast.

Installation cost:

Estimated installed cost: $20,360 (includes $9,062 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
22,655	2,295	20,360	10,516	2.2	0	2.5	1,334	2,932	15	43,980	6.9	116%	8%	12	14,141	18,830

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 30 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 $2,295.

Please see Appendix F for more information on Incentive Programs

ECM#8: Install a 50 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 50 kW system needs approximately 217 panels which would take up 3,804 square feet.

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

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

Installation cost:

Estimated installed cost: $335,000 (includes $134,000 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
375,000	40,000	335,000	59,020	50.0	0	14.0	0	44,371	25	755,276	7.5	125	5	11	227,077	105,675

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
-335,000	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371	44,371

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
44,371	44,371	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971

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 $40,000 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 $35,400 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

Please see Appendix F for more information on Incentive Programs.

ECM#9: Replace Old Police Department Heat Pump with ENERGY STAR® Efficient Type

During the field audit, SWA completed the building HVAC equipment inventory and observed spaces heated/cooled by heat pumps. Electric air-source heat pumps, often used in moderate climates, use the difference between outdoor air temperatures and indoor air temperatures to cool and heat. ENERGY STAR® qualified heat pumps have a higher seasonal efficiency rating (SEER) and heating seasonal performance factor (HSPF) than standard models, which makes them about 8% percent more efficient than standard new models and 20% more efficient then older units. The labor for the recommended installations is evaluated using prevailing mechanical/electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor. The Police Department heat pump is operating beyond its expected service life.

Installation cost:

Estimated installed cost: $4,770 (includes $ 1,431 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program, Similar projects

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5,000	230	4,770	3,260	0.7	0	0.8	100	596	15	8,933	8.0	87	6	9	2,168	5,837

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA used Energy Star site: http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing , Excel spreadsheet for Air Source Heat Pump Savings Calculator. Upgraded heat pump is assumed to be 15 SEER vs. 10 SEER of the existing.

Rebates/financial incentives:

- NJ Clean Energy - SmartStart - air-to-air heat pump systems for <5.4 tons ($92 per ton) - Maximum incentive amount is $230.

Please see Appendix F for more information on Incentive Programs.

ECM#10: Replace Two (2) Large Refrigerators with 17 cu. ft. ENERGY STAR® Models

On the day of the site visit, SWA observed that there were two older refrigerators, 17 cu. ft. model in the building which were not ENERGY STAR® rated (using approximately 773 kWh/year). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerators with a 17 cu. ft. top freezer ENERGY STAR® refrigerator. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, ENERGY STAR® equipment results in large savings. Look for the ENERGY STAR® label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $1,050 (Includes $150 in labor cost)
Source of cost estimate: Manufacturer and Store established costs

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1,050	none at this time	1,050	850	0.2	0	0.2	0	129	15	1,938	8.1	85	6	9	456	1,522

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

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#11: Replace Six (6) Compact Refrigerators with 2.7 cu. ft. ENERGY STAR® Models

On the day of the site visit, SWA observed that there were six older 2.7 cu. ft. model refrigerators that are not ENERGY STAR® rated (using approximately 254 kWh/year). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the older model compact refrigerators with a 2.7 cf. ft. ENERGY STAR® model or equivalent. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, ENERGY STAR® equipment results in large savings. Look for the ENERGY STAR® label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $596 (Includes $120 in labor cost)
Source of cost estimate: Manufacturer and Store established costs

Economics:

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
596	none at this time	596	480	0.1	0	0.1	0	73	15	1,094	8.2	84	6	9	254	859

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

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#12: Install Two New ENERGY STAR® Label Washing Machines

On the day of the site visit, SWA observed that there were two older model washing machines installed in the Fire Department. SWA recommends replacing these units with two new ENERGY STAR® labeled washing machines.

Installation Cost:

Estimated installed cost: $1,200 (Includes $200 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
1,200	none at this time	1,200	680	0.1	0	0.2	28	131	15	1,970	9.1	64	4	7	334	1,218

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs

ECM#13: Replace Old Boiler with an ENERGY STAR® Efficient Condensing Model

During the field audit, SWA inspected the old boiler on site which is not ENERGY STAR® rated, nor a condensing model. This boiler is operating beyond its estimated service life. SWA recommends the replacement of existing old and inefficient boilers.

High-efficiency condensing boilers are now available with advanced touch screen control systems. They feature stainless steel heat exchanger technology with modulating/condensing combustion to deliver thermal efficiency as high as 98%. Available models can produce 1.0, 1.3 and 1.5 million BTU/hr inputs, low NOx operation and 10:1 turndown, serving a wide range of commercial applications, offering cutting-edge green technology for today's building owners and facility managers.

The touch screen technology makes it easier than ever to set up a perfectly synchronized green system and allows access to a complete onboard database of real-time operations data and performance history. Boilers can be equipped with a built-in cascading sequencer for up to eight boilers and can deliver up to 12 million BTU/hr heating capacity. In addition, there is capability for full system integration with Modbus communication protocol, as well as the ability to connect with optional software to download and track historical data, including faults, trends and energy consumption. Other standard control features include outdoor reset, three pump control, night setback, hot water generator compatibility and password security.

To ensure easy handling on the jobsite, the new condensing boilers feature a space-saving footprint and a direct-vent design with intake and exhaust (PVC) runs up to 100 feet. These compact boilers easily fit through a standard doorway and offers zero clearance to combustibles. Featuring an ASME stainless steel heat exchanger, they are remarkably lightweight compared to other boilers in their class.

SWA proposes replacing the 1969 vintage Weil-McLain cast iron sectional hot water boiler, 1,320,000 BTUH input, 80% efficient, estimated to have degraded to 75% with a condensing type boiler, 1,000,000 BTUH, >90% efficient and latest turndown and reset controls.

Installation cost:

Estimated installed cost: $29,750 (includes $ 8,475 of labor)
Source of cost estimate: Manufacturer/Store costs, NJ Clean Energy Program, Similar Projects

Economics (with incentives):

est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Replace 1 old 80% efficient boiler - 1,320 MBH input in kind																
25,000	0	25,000	0	0.0	438	3.1	500	1,229	25	30,725	20.3	23	1	2	-3,942	4,829
Incremental difference to replace 1 old 80% efficient boiler with 1,000 MBH input condensing model - >90% efficient																
6,500	1,750	4,750	0	0.0	1,139	7.9	0	1,895	25	47,385	2.5	898	36	40	26,678	12,556
Replace 1 old 80% efficient boiler with 1,000 MBH input condensing model - >90% efficient																
31,500	**1,750**	**29,750**	**0**	**0.0**	**1,577**	**11.0**	**500**	**3,124**	**25**	**78,110**	**9.5**	**163**	**7**	**9**	**22,735**	**17,385**

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing unit requires additional annual repairs vs. a new boiler. The new boiler will also have better turndown and a vent damper to reduce cooling from outdoor air in-between heating cycles.

Rebates/financial incentives:

- NJ Clean Energy - SmartStart - Heating Equipment Efficiencies, >300-1,500 MBH, 85% eff ($1.75 per MBH) - Maximum incentive amount is $1,750.

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 Northfield Municipal Building:

- 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 heating terminal units - such as perimeter baseboard coils, ceiling hung hydronic unit heaters and cabinet hydronic unit heaters located throughout the building. This equipment is in fair condition and is beyond its expected service life. Age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended to improve the overall efficiency of the heating system. This is a replacement in kind recommendation which offers negligible energy savings. The estimated installed cost is $350,000 with a payback in excess of 40 years.

- The Municipal Building should consider replacing the standard efficiency gas fired DHW heater with a gas fired condensing type DHW heater of approximately 95% efficiency when the present heater has reached the end of its life cycle of approximately 12 years.

- Replace four (4) electric baseboard heaters in kind in the Police Department administration offices when the existing reach the end of their expected service lives of 20 years. The existing units have integral knob operated thermostats on them and are in fair condition. The new units should be set up to be controlled by programmable room thermostats. There is negligible energy savings associated with this replacement.

- Replace storage, bathroom and engine bay exhaust fans - this equipment is operating beyond expected service life, run by fractional horsepower motors and the run hours are not significant, so the replacements cannot be justified by energy savings alone and there are no NJ Clean Energy rebates available. However, due to the age of the equipment, replacement is recommended.

- Replace heating hot water circulators - this equipment is operating beyond expected service life, run by 1/4 horsepower motors with an installed spare. The replacements cannot be justified by the negligible energy savings and there are no NJ Clean Energy rebates available. However, due to the age of the equipment, replacement is recommended.

Operations and Maintenance

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

- Insure that heating hot water circulator controls are working properly and that circulator pumps are shut down when the building does not require heat.

- Thoroughly and evenly insulate space above the drop ceiling tiles and plug all ceiling penetration. All missing ceiling tiles should be put back in place.

- Air balance distributed conditioned air - for uniform and steady temperature control. This activity is also included in Retro-commissioning, ECM#6.

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

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

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

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

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

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

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

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

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Northfield Municipal Building. Based on the requirements of the LGEA program, the Northfield Municipal Building 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 Northfield Municipal Building should spend a minimum of $2,088 (or 25% of $8,351) worth of ECMs, net of other NJCEP incentives, to fulfill the obligations.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	Weil-McLain hot water boiler cast iron sectional - 1,320,000 BTUH input, 1,056,000 BTUH output, 80% eff (no flue vent damper valve)	J-9-B, Series J-B, Serial # 1325	Natural Gas	Boiler room (Basement)	Muni Bldg	1969	0
Heating	2 B&G circulating hot water pumps (one running all the time –even when no heat distributed!)	¼ HP model, illegible tags	Electric to motors	Boiler room (Basement)	Muni Bldg	1969	0
Heating	Modine cabinet heaters (with manual knob for heat adjustment)	Missing name tags	Electric to fan motors	Throughout the bldg	Throughout the bldg	1969	0
Heating	4 Electric baseboard heaters (with manual knob for heat adjustment)	Missing name tags	Electric	Police Dept (4 admin offices)	Police Dept (4 admin offices)	1994	25
Heating	4 Modine hydronic ceiling hung units (controlled by 1 manual thermostat set @64F?) –fract fan HP	HS-280, Ser. #: 05E056	Electric for fans	Fire Bay ceiling	Fire Bays	1969	0
Cooling	RTU Trane (control is in Fire Dept front office)	Condenser Model: TCC018F100 B6 / Serial: 4272N2B2H	Electric	Rooftop	Fire Dept	2006	75
Cooling/ Heating	Carrier heat pump (control in front admin offices - by manual thermostat); 2.5 ton, est 10 SEER	Condenser/Evap Model: 384CC030340 / Serial: 2703E28050	Electric	Rooftop	Police Dept (4 offices & City Clerk)	1994	0
Cooling	Trane (programmable thermostat - operated manually); 5 ton - R22; 10 SEER	Condenser Model: 2TTB3060A1000AA / Serial: 6051Y4EIF	Electric	Rooftop	Council Chamber area	2006	75
Cooling	Carrier/Payne (controls on Processing hallway wall)	Condenser Model: PH105A04246B / Serial: 1901E27835	Electric	Rooftop	Jail Area / Processing Area	2006	75
Continued on the next page							

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.

continued from the previous page							
Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Cooling	Sanyo mini split ductless AC; 1 ton cooling, est SEER 10.2	Model: CL1251/ Serial: 0053334/ 4332412B1H	Electric	Inspection Office (condenser is in front of bldg)	Inspection Office (Basement)	2004	60
Cooling	Trane Heat Pump (controls in hallway by Foyer); est 13.25 SEER	Model: XB132TIB306 OA1000AA / Serial: 6051YYE1FA	Electric for fan	Rooftop	City Hall Foyer	2006	75
Cooling	Sanyo mini split ductless AC; 1 ton cooling; est SEER 10	Model: CH1222 / Serial: 0019351-6327	Electric	Court Office (condenser - back of bldg)	Court Office	1996	10
Cooling	Carrier AC (controls in Court Office); 5 ton - R22; 11.5 SEER	Condenser Model: 38CK060370 / Serial: 2402E18480	Electric	Rooftop	Court Office area	2006	75
Cooling	Comfort Air Conditioner (additional room cooling) - 18,000 Btu/hr - EER 9.7 – R22 refrigerant	RAD-183A	Electric	Tax office (window mounted AC)	Tax office	2006	60
Cooling	24,000Btu/hr - 9.8 EER-R22 refrigerant - through the wall unit	Illegible Name Tag	Electric	Court room office	Court room office	Before 1995	0
Domestic Hot Water (DHW) Heating	Bradford White - Defender Hydrojet 50 gal storage; est EF is 0.62	M15036FBN, Serial # 532076	Natural Gas	Boiler room (Basement)	Muni Bldg	2006	65
Ventilation	4 x 1/2 HP exhaust fans	No name tags	Electric	Basement outer walls	Basement storage areas (2 back, 2 front of bldg)	1969	0
Ventilation	8 fractional HP exhaust fans	Penn DX10S and others without name tags	Electric	Rooftop	Various bldg spaces (bathrooms, storage, engine bays, generator…)	1969	0
Generator	Kohler 39 kW/49 kVA/0.8 PF	45RZ; Serial # 0646187	Natural Gas /Electric	Shed rear of Fire Dept	Muni Bldg	1990	20
Instrument Air	I-R compressor used ~15 times a year to fill cylinders with pressurized air	BAP10TV1, Ser #: 30T697431	Electric	Fire Dept back room	Air cylinders for Fire engines	1992	10
Lighting	See details - Appendix B	-	Electric	See details - Appendix B	Library	varies	avg 25

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	Office Area - Clerks (103)	Recessed	M	4'T12	6	4	34	Sw	8	240	10	877	1,684	T8	Recessed	4'T8	E	OS	6	4	32	6	240	5	798	1149	152	383	535
2	1	Office - Clerk (103)	Recessed	M	4'T12	3	4	34	Sw	8	240	10	439	842	T8	Recessed	4'T8	E	Sw	3	4	32	8	240	5	399	766	76	0	76
3	1	Clerks Office Storage Room (103)	Recessed	M	4'T12	1	2	34	Sw	2	240	10	78	38	T8	Recessed	4'T8	E	Sw	1	2	32	2	240	5	69	33	4	0	4
4	1	Office - Clerk (103)	Exit Sign	S	Fl.	1	2	15	N	24	365	2	32	276	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	228	0	228
5	1	Vestibule	Recessed	M	4'T12	1	4	34	Sw	8	365	10	146	427	T8	Recessed	4'T8	E	Sw	1	4	32	8	365	5	133	388	39	0	39
6	1	Vestibule	Recessed	E	4'T8	1	4	32	Sw	8	365	5	133	388	N/A	Recessed	4'T8	E	Sw	1	4	32	8	365	5	133	388	0	0	0
7	1	Office - Lt. Faden	Recessed	M	4'T12	1	4	34	Sw	8	365	10	146	427	T8	Recessed	4'T8	E	Sw	1	4	32	8	365	5	133	388	39	0	39
8	1	Office - Chief	Recessed	M	4'T12	1	4	34	Sw	8	365	10	146	427	T8	Recessed	4'T8	E	Sw	1	4	32	8	365	5	133	388	39	0	39
9	1	Office - Chief	Recessed	E	4'T8	2	4	32	Sw	8	365	5	266	777	N/A	Recessed	4'T8	E	Sw	2	4	32	8	365	5	266	777	0	0	0
10	1	Office - Captain	Recessed	M	4'T12	2	4	34	Sw	8	365	10	292	854	T8	Recessed	4'T8	E	OS	2	4	32	6	365	5	266	583	77	194	271
11	1	Office - Lt. Mitchell	Recessed	M	4'T12	2	4	34	Sw	8	365	10	292	854	T8	Recessed	4'T8	E	OS	2	4	32	6	365	5	266	583	77	194	271
12	1	Vestibule	Recessed	M	4'T12	1	3	34	Sw	24	365	10	112	983	T8	Recessed	4'T8	E	Sw	1	3	32	24	365	5	101	885	98	0	98
13	1	Hallway	Recessed	M	4'T12	1	3	34	Sw	24	365	10	112	983	T8	Recessed	4'T8	E	Sw	1	3	32	24	365	5	101	885	98	0	98
14	1	Hallway	Recessed	E	4'T8	1	4	32	Sw	24	365	5	133	1,165	N/A	Recessed	4'T8	E	Sw	1	4	32	24	365	5	133	1165	0	0	0
15	1	Office - Detectives Bureau	Recessed	E	4'T8	6	3	32	Sw	8	365	5	606	1,770	C	Recessed	4'T8	E	OS	6	3	32	6	365	5	606	1327	0	442	442
16	1	Hallway	Exit Sign	S	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	215	0	215
17	1	Lobby	Exit Sign	S	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	215	0	215
18	1	Lobby	Recessed	M	4'T12	1	4	34	Sw	24	365	10	146	1,281	T8	Recessed	4'T8	E	Sw	1	4	32	24	365	5	133	1165	116	0	116
19	1	Office - Records	Recessed	M	4'T12	2	4	34	Sw	4	365	10	292	427	T8	Recessed	4'T8	E	Sw	2	4	32	4	365	5	266	388	39	0	39
20	1	Office - Interview Room	Recessed	E	4'T8	2	4	32	Sw	8	365	5	266	777	N/A	Recessed	4'T8	E	Sw	2	4	32	8	365	5	266	777	0	0	0
21	1	Bathroom	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	4	365	5	69	101	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	4	365	5	69	101	0	0	0
22	1	Kitchen	Recessed	M	4'T12	1	4	34	Sw	4	365	10	146	213	T8	Recessed	4'T8	E	Sw	1	4	32	4	365	5	133	194	19	0	19
23	1	Bathroom	Recessed	M	4'T12	1	2	34	Sw	4	365	10	78	114	T8	Recessed	4'T8	E	Sw	1	2	32	4	365	5	69	101	13	0	13
24	1	Office - Patrol Room 2	Recessed	M	4'T12	1	4	34	Sw	24	365	10	146	1,281	T8	Recessed	4'T8	E	OS	1	4	32	18	365	5	133	874	116	291	407
25	1	Office - Patrol Room 2	Recessed	E	4'T8	1	2	32	Sw	24	365	5	69	604	N/A	Recessed	4'T8	E	Sw	1	2	32	24	365	5	69	604	0	0	0
26	1	Office - Patrol Room 2 Storage	Ceiling Mounted	S	Inc	1	1	60	Sw	2	365	0	60	44	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	365	0	20	15	29	0	29
27	1	Server Room Occupied	Recessed	E	4'T8	1	4	32	Sw	4	365	5	133	194	N/A	Recessed	4'T8	E	Sw	1	4	32	4	365	5	133	194	0	0	0
28	1	Server Room Occupied	Recessed	M	4'T12	1	2	34	Sw	4	365	10	78	114	T8	Recessed	4'T8	E	Sw	1	2	32	4	365	5	69	101	13	0	13
29	1	Office	Recessed	M	4'T12	1	2	34	Sw	8	365	10	78	228	T8	Recessed	4'T8	E	Sw	1	2	32	8	365	5	69	201	27	0	27
30	1	Processing Room	Recessed	M	4'T12	1	4	34	Sw	4	365	10	146	213	T8	Recessed	4'T8	E	Sw	1	4	32	4	365	5	133	194	19	0	19
31	1	Processing Room	Recessed	E	4'T8	2	4	32	Sw	4	365	5	266	388	N/A	Recessed	4'T8	E	Sw	2	4	32	4	365	5	266	388	0	0	0
32	1	Holding Area	Ceiling Mounted	S	CFL	1	1	18	Sw	4	365	0	18	26	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	4	365	0	18	26	0	0	0
33	1	Holding Area	Ceiling Mounted	S	CFL	1	1	18	Sw	4	365	0	18	26	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	4	365	0	18	26	0	0	0
34	1	Holding Cell	Wall Mounted	M	2'T12	1	2	20	Sw	4	365	6	46	67	T8	Wall Mounted	2'T8	E	Sw	1	2	17	4	365	2	36	53	15	0	15
35	1	Storage Room	Ceiling Mounted	S	CFL	1	1	18	Sw	2	365	0	18	13	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	2	365	0	18	13	0	0	0
36	1	Holding Area	Ceiling Mounted	S	CFL	1	1	18	Sw	8	365	0	18	53	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	8	365	0	18	53	0	0	0
37	1	Holding Area	Ceiling Mounted	S	CFL	1	1	18	Sw	8	365	0	18	53	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	8	365	0	18	53	0	0	0
38	1	Holding Cell	Wall Mounted	M	2'T12	1	2	20	Sw	4	365	6	46	67	T8	Wall Mounted	2'T8	E	Sw	1	2	17	4	365	2	36	53	15	0	15
39	1	Storage Room	Ceiling Mounted	S	CFL	1	1	18	Sw	2	365	0	18	13	N/A	Ceiling Mounted	CFL	S	Sw	1	1	18	2	365	0	18	13	0	0	0
40	1	Hallway	Exit Sign	S	Inc	1	1	15	Sw	24	365	0	15	131	LEDex	Exit Sign	LED	S	Sw	1	1	5	24	365	1	6	48	83	0	83
41	1	Hallway	Recessed	M	4'T12	3	4	34	Sw	24	365	10	439	3,842	T8	Recessed	4'T8	E	Sw	3	4	32	24	365	5	399	3495	347	0	347
42	1	Hallway	Recessed	E	4'T8	1	4	32	Sw	24	365	5	133	1,165	N/A	Recessed	4'T8	E	Sw	1	4	32	24	365	5	133	1165	0	0	0
43	1	Office - Sergeant	Recessed	E	4'T8	2	4	32	Sw	8	365	5	266	777	N/A	Recessed	4'T8	E	Sw	2	4	32	8	365	5	266	777	0	0	0
44	Bsmt	Evidence Room	Ceiling Mounted	S	Inc	4	1	60	Sw	2	365	0	240	175	CFL	Ceiling Mounted	CFL	S	Sw	4	1	20	2	365	0	80	58	117	0	117
45	Bsmt	Armory	Ceiling Mounted	M	4'T12	3	1	34	Sw	2	365	10	133	97	T8	Ceiling Mounted	4'T8	E	Sw	3	1	32	2	365	5	111	81	16	0	16
46	Bsmt	Armory	Ceiling Mounted	S	Inc	1	1	60	Sw	2	365	0	60	44	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	365	0	20	15	29	0	29
47	1	Lobby	Recessed	M	4'T12	4	4	34	Sw	8	240	10	585	1,123	T8	Recessed	4'T8	E	Sw	4	4	32	8	240	5	532	1021	101	0	101
48	1	Lobby	Exit Sign	S	Inc	1	1	15	Sw	24	365	0	15	131	LEDex	Exit Sign	LED	S	Sw	1	1	5	24	365	1	6	48	83	0	83
49	1	Office - Tax Assessor (134)	Recessed	M	4'T12	8	4	34	Sw	8	240	10	1,170	2,246	T8	Recessed	4'T8	E	Sw	8	4	32	8	240	5	1064	2043	203	0	203

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)
50	1	Tax Assessor Storage Room (134)	Recessed	S	CFL	1	1	18	Sw	2	240	0	18	9	N/A	Recessed	CFL	S	Sw	1	1	18	2	240	0	18	9	0	0	0
51	1	Tax Assessor Office (134)	Recessed	M	4'T12	2	4	34	Sw	8	240	10	292	561	T8	Recessed	4'T8	E	Sw	2	4	32	8	240	5	266	511	51	0	51
52	1	Hallway	Recessed	M	4'T12	5	2	34	Sw	8	240	10	391	751	T8	Recessed	4'T8	E	Sw	5	2	32	8	240	5	345	662	88	0	88
53	1	Office Area - Finance (131)	Recessed	M	4'T12	3	4	34	Sw	8	240	10	439	842	T8	Recessed	4'T8	E	Sw	3	4	32	8	240	5	399	766	76	0	76
54	1	Office - Finance (131)	Recessed	M	4'T12	2	4	34	Sw	8	240	10	292	561	T8	Recessed	4'T8	E	Sw	2	4	32	8	240	5	266	511	51	0	51
55	1	Hallway	Recessed	M	4'T12	2	2	34	Sw	8	240	10	156	300	T8	Recessed	4'T8	E	Sw	2	2	32	8	240	5	138	265	35	0	35
56	1	Bathroom Men	Recessed	M	4'T12	2	4	34	OS	4	240	10	292	281	T8	Recessed	4'T8	E	OS	2	4	32	4	240	5	266	255	25	0	25
57	1	Bathroom Women	Recessed	M	4'T12	2	4	34	OS	4	240	10	292	281	T8	Recessed	4'T8	E	OS	2	4	32	4	240	5	266	255	25	0	25
58	1	Court Room (125)	Recessed	M	4'T12	9	4	34	Sw	4	240	10	1,316	1,263	T8	Recessed	4'T8	E	Sw	9	4	32	4	240	5	1197	1149	114	0	114
59	1	Court Room (125)	Recessed	E	4'T8	5	4	32	Sw	4	240	5	665	638	N/A	Recessed	4'T8	E	Sw	5	4	32	4	240	5	665	638	0	0	0
60	1	Court Room (125)	Exit Sign	S	Inc	2	3	15	Sw	24	365	0	90	788	LEDex	Exit Sign	LED	S	Sw	2	1	5	24	365	1	11	96	692	0	692
61	1	Court Room (125)	Track	S	Hal	1	3	90	Sw	4	365	20	290	423	CFL	Track	CFL	S	Sw	1	3	30	4	365	0	90	131	292	0	292
62	1	Janitor's Closet	Ceiling Mounted	S	Inc	1	1	60	Sw	2	365	0	60	44	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	365	0	20	15	29	0	29
63	1	Office - Violations Bureau (128)	Recessed	M	4'T12	4	4	34	Sw	8	240	10	585	1,123	T8	Recessed	4'T8	E	Sw	4	4	32	8	240	5	532	1021	101	0	101
64	Bsmt	Mechanical Room	Parabolic Ceiling Suspendec	M	4'T12	3	2	34	Sw	2	365	10	235	171	T8	Parabolic Ceiling Suspende	4'T8	E	Sw	3	2	32	2	365	5	207	151	20	0	20
65	Bsmt	Hallway	Ceiling Mounted	M	4'T12	10	2	34	Sw	8	365	10	782	2,283	T8	Ceiling Mounted	4'T8	E	Sw	10	2	32	8	365	5	690	2015	269	0	269
66	Bsmt	Hallway	Exit Sign	S	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	215	0	215
67	Bsmt	Office - Building Department	Recessed	M	4'T12	6	4	34	Sw	8	365	10	877	2,561	T8	Recessed	4'T8	E	OS	6	4	32	6	365	5	798	1748	231	583	814
68	Bsmt	Electrical Room	Ceiling Mounted	M	4'T12	1	2	34	Sw	2	365	10	78	57	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	365	5	69	50	7	0	7
69	Bsmt	Storage Room	Track	S	CFL	22	1	18	Sw	2	365	0	396	289	N/A	Track	CFL	S	Sw	22	1	18	2	365	0	396	289	0	0	0
70	Bsmt	Storage Room	Track	S	Hal	2	1	90	Sw	2	365	20	220	160	CFL	Track	CFL	S	Sw	2	1	30	2	365	0	60	44	117	0	117
71	Bsmt	Storage Room	Ceiling Mounted	M	8'T12	2	2	80	Sw	2	365	20	360	263	T8	Ceiling Mounted	8'T8	E	Sw	2	2	59	2	365	7	250	183	80	0	80
72	Bsmt	EMS Rescue Room	Recessed	E	4'T12	8	4	34	Sw	24	365	10	1,170	10,246	T8	Recessed	4'T8	E	Sw	8	4	32	24	365	5	1064	9321	925	0	925
73	Bsmt	EMS Rescue Room	Recessed	M	2'T12	1	4	20	Sw	24	365	6	86	753	T8	Recessed	2'T8	E	Sw	1	4	17	24	365	2	70	613	140	0	140
74	Bsmt	EMS Rescue Room Storage Closet	Ceiling Mounted	M	4'T12	1	1	34	Sw	2	365	10	44	32	T8	Ceiling Mounted	4'T8	E	Sw	1	1	32	2	365	5	37	27	5	0	5
75	Bsmt	EMS Rescue Room Storage Closet	Ceiling Mounted	M	4'T12	1	1	34	Sw	2	365	10	44	32	T8	Ceiling Mounted	4'T8	E	Sw	1	1	32	2	365	5	37	27	5	0	5
76	Bsmt	EMS Rescue Room Storage Closet	Ceiling Mounted	M	4'T12	1	1	34	Sw	2	365	10	44	32	T8	Ceiling Mounted	4'T8	E	Sw	1	1	32	2	365	5	37	27	5	0	5
77	1	Office - Mayor	Recessed	M	4'T12 U-Shapec	6	2	34	Sw	8	240	10	469	901	T8	Recessed	4'T8 U-Shapec	E	Sw	6	2	32	8	240	5	414	795	106	0	106
78	Str	Staircase	Ceiling Mounted	M	4'T12	1	2	34	Sw	8	240	10	78	150	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	8	240	5	69	132	18	0	18
79	GF	Garage	Ceiling Mounted	M	8'T12	12	2	80	Sw	24	365	20	2,160	18,922	T8	Ceiling Mounted	8'T8	E	Sw	12	2	59	24	365	7	1500	13140	5782	0	5782
80	GF	Storage Room	Ceiling Mounted	M	8'T12	3	2	80	Sw	2	365	20	540	394	T8	Ceiling Mounted	8'T8	E	Sw	3	2	59	2	365	7	375	274	120	0	120
81	GF	Kitchen	Recessed	M	4'T12	1	4	34	Sw	4	365	10	146	213	T8	Recessed	4'T8	E	Sw	1	4	32	4	365	5	133	194	19	0	19
82	GF	Bathroom Men	Recessed	M	4'T12	1	4	34	Sw	4	365	10	146	213	T8	Recessed	4'T8	E	Sw	1	4	32	4	365	5	133	194	19	0	19
83	GF	Bathroom Men	Recessed	S	CFL	1	1	13	Sw	4	365	0	13	19	N/A	Recessed	CFL	S	Sw	1	1	13	4	365	0	13	19	0	0	0
84	GF	Dispatch Room	Recessed	M	4'T12	2	2	34	Sw	24	365	10	156	1,370	T8	Recessed	4'T8	E	Sw	2	2	32	24	365	5	138	1209	161	0	161
85	GF	Office	Recessed	M	4'T12	2	2	34	Sw	8	365	10	156	457	T8	Recessed	4'T8	E	Sw	2	2	32	8	365	5	138	403	54	0	54
86	Bsmt	ffice Area - Emergency Manageme	Recessed	M	4'T12	7	4	34	Sw	4	365	10	1,023	1,494	T8	Recessed	4'T8	E	Sw	7	4	32	4	365	5	931	1359	135	0	135
87	Bsmt	Emergency Management Closet	Parabolic Ceiling Suspendec	M	4'T12	1	2	34	Sw	4	365	10	78	114	T8	Parabolic Ceiling Suspende	4'T8	E	Sw	1	2	32	4	365	5	69	101	13	0	13
88	Bsmt	Communications Office	Recessed	M	4'T12	4	4	34	Sw	4	365	10	585	854	T8	Recessed	4'T8	E	Sw	4	4	32	4	365	5	532	777	77	0	77
89	Ext	Exterior	Wallpack	M	HPS	5	1	50	PC	12	365	10	300	1,314	N/A	Wallpack	HPS	M	PC	5	1	50	12	365	10	300	1314	0	0	0
90	Ext	Exterior	Pole Mounted	S	MH	6	1	400	PC	12	365	112	3,072	13,455	PSMH	Pole Mounted	PSMH	S	PC	6	1	250	12	365	50	1800	7884	5571	0	5571
91	Ext	Vestibule	Recessed	S	CFL	3	1	18	Sw	12	365	0	54	237	N/A	Recessed	CFL	S	Sw	3	1	18	12	365	0	54	237	0	0	0
92	Ext	Exterior	Ceiling Mounted	S	CFL	7	1	18	Sw	12	365	0	126	552	N/A	Ceiling Mounted	CFL	S	Sw	7	1	18	12	365	0	126	552	0	0	0
93	Ext	Exterior	Sconce	S	CFL	6	1	23	PC	12	365	0	138	604	N/A	Sconce	CFL	S	PC	6	1	23	12	365	0	138	604	0	0	0
94	Ext	Roof	Flood	S	MH	2	1	150	PC	12	365	42	384	1,682	PSMH	Flood	PSMH	S	PC	2	1	100	12	365	20	240	1051	631	0	631
95	Ext	Exterior	Flood	S	MH	2	1	50	PC	12	365	14	128	561	N/A	Flood	MH	S	PC	2	1	50	12	365	14	128	561	0	0	0
Totals:						257	244	3,707				847	28,400	96,965						257	238	2,989			425	23,608	75,816	19,061	2,088	21,149

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	14,346		
Average Power Cost ($/kWh)	0.1520		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	18,405	12,203	**6,202**
Exterior Power (watts)	4,202	2,786	**1,416**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	78,560	63,613	**14,947**
Lighting Power (watts)	24,198	20,822	**3,376**
Lighting Power Density (watts/SF)	1.69	1.45	**0.24**
Estimated Cost of Fixture Replacement ($)	25,954		
Estimated Cost of Controls Improvements ($)	1,200		
Total Consumption Cost Savings ($)	**4,788**		

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS
http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for Atlantic City Electric Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com

Third Party Gas Suppliers for South Jersey Gas Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
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.

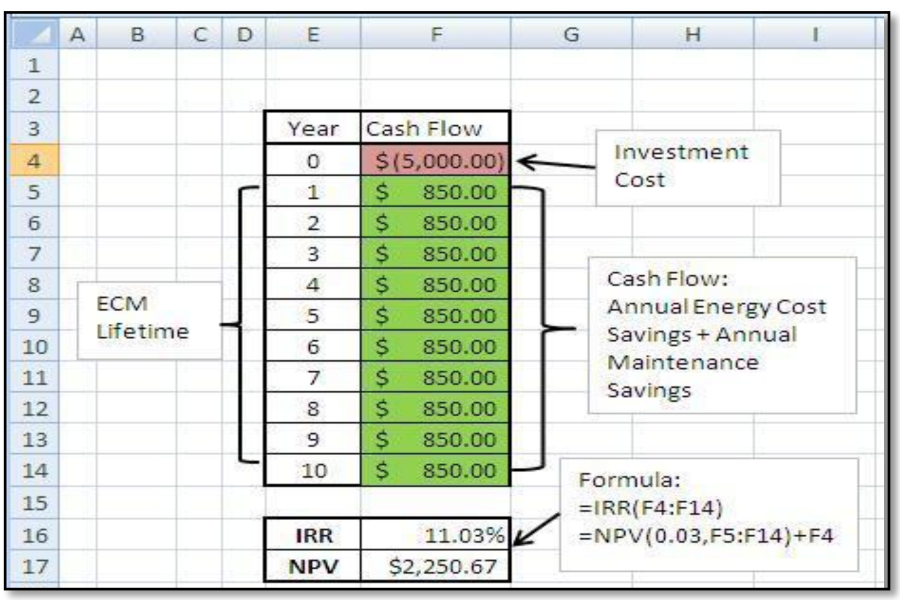
Calculation References

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

ENERGY STAR

STATEMENT OF ENERGY PERFORMANCE
City of Northfield - City Hall

Building ID: 2363525
For 12-month Period Ending: March 31, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 23, 2010

Facility
City of Northfield - City Hall
1600 Shore Road
Northfield, NJ 08225

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1969
Gross Floor Area (ft²): 14,346

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	783,065
Natural Gas (kBtu)[4]	922,662
Total Energy (kBtu)	1,705,727

Energy Intensity[5]	
Site (kBtu/ft²/yr)	119
Source (kBtu/ft²/yr)	250

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	168

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	17%
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. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

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

Direct Install 2010 Program

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

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program

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

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

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

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

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

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

Other Federal and State Sponsored Programs

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

APPENDIX G: 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 Space Temperature Control with Programmable Thermostats		8,750	none at this time	8,750	4,416	0.9	876	7.2	1,167	3,296	12	39,551	2.7	352	29	37	22,935	17,565
2	Install Eight (8) New LED Exit Signs		1,081	160	921	1,730	0.4	0	0.4	64	327	15	4,911	2.8	433	29	35	2,932	3,098
3	Install Six (6) New Occupancy Sensors		1,320	120	1,200	2,088	0.4	0	0.5	0	317	15	4,760	3.8	297	20	26	2,534	3,738
4	Install Ten (10) New CFL Fixtures		404	none at this time	404	613	0.1	0	0.1	12	105	5	527	3.8	31	6	10	76	1,097
5	Install Eight (8) New Pulse Start Metal Halide Fixtures		4,470	200	4,270	6,202	1.3	0	1.5	163	1,106	15	16,586	3.9	288	19	25	8,741	11,105
6	Retro-commissioning the HVAC System		17,933	none at this time	17,933	5,752	1.2	876	7.5	1,820	4,152	12	49,828	4.3	178	15	21	22,200	19,958
	Totals		**33,957**	**480**	**33,477**	**20,801**	**4.3**	**1,752**	**17.2**	**3,226**	**9,304**	**-**	**116,163**	**3.6**	**247**	**-**	**26**	**58,976**	**56,560**

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	Install One Hundred and Fifty-Three (153) New T8 Fluorescent Fixtures		22,655	2,295	20,360	10,516	2.2	0	2.5	1,334	2,932	15	43,980	6.9	116%	8%	12	14,141	18,830
8	Install a 50 kW Solar Photovoltaic Rooftop System		375,000	40,000	335,000	59,020	50.0	0	14.0	0	44,371	25	755,276	7.5	125	5	11	227,077	105,675
9	Replace Old Police Department Heat Pump with Energy Star Efficient Type		5,000	230	4,770	3,260	0.7	0	0.8	100	596	15	8,933	8.0	87	6	9	2,168	5,837
10	Replace Two (2) Large Refrigerators with 17 cu. ft. ENERGY STAR® Models		1,050	none at this time	1,050	850	0.2	0	0.2	0	129	15	1,938	8.1	85	6	9	456	1,522
11	Replace Six (6) Compact Refrigerators with 2.7 cu. ft. ENERGY STAR® Models		596	none at this time	596	480	0.1	0	0.1	0	73	15	1,094	8.2	84	6	9	254	859
12	Install Two New ENERGY STAR® Label Washing Machines		1,200	none at this time	1,200	680	0.1	0	0.2	28	131	15	1,970	9.1	64	4	7	334	1,218
13	Replace Old Boiler with an Energy Star Efficient Condensing Model		31,500	1,750	29,750	0	0.0	1,577	11.0	500	3,124	25	78,110	9.5	163	7	9	22,735	17,385
	Totals		**437,001**	**44,275**	**392,726**	**74,806**	**53.3**	**1,577**	**28.8**	**1,962**	**51,356**	**-**	**891,301**	**7.6**	**127**	**-**	**11**	**266,727**	**151,326**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tools:	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.