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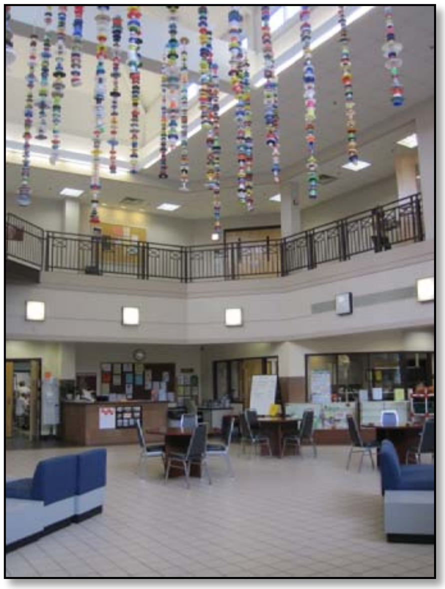

Township of Cranford
Community Center

FINAL

Local Government Energy Program
Energy Audit Draft Report

220 Walnut Ave
Cranford, NJ 07016

Project Number: LGEA77

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EXECUTIVE SUMMARY

The Community Center building is a two story building with a partial basement comprising a total conditioned floor area of 34,782 square feet. The original building was gut renovated in 2000, except for structure and shell. The following chart provides an overview of current energy usage in the building based on the analysis period of July 2009 through June 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	385,730	19,653	N/A	$85,951	94.0	3,282
Proposed	316,990	16,451	N/A	$71,351	78.1	2,726
Savings	68,740	3,202	N/A	$14,600*	15.9	555.5
% Savings	17.8%	16.3%	N/A	17.0%	16.9%	16.9%
Proposed Renewables	35,400	Includes SRECs		26,910	3.5	121
*Includes operation and maintenance savings						

There may be energy procurement opportunities for the Community Center building to reduce annual electric utility costs, which are $6,537 higher when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the community center building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This facility was compared to "Other-recreation" building type, and is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 94 kBtu/ft^2-yr compared to the national average of a recreation building consuming 65 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.

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

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	$11,728	4.0	$46,681	124,912
5-10 Year	$2,872	9.1	$26,055	33,146
>10 year	N/A	N/A	N/A	N/A
Total	$14,600	5.0	$72,736	158,058
Proposed Renewables	26,910	7.0	187,500	63,384

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 13 cars from the roads each year or the equivalent of planting 385 trees to offset the annual CO2 emissions 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

- o Install premium motors when replacements are required.
- o Replace all existing electric cabinet unit heaters

- o Replace all old exhaust fans
- o Replace existing ceiling radiant heating panels in Preschool room

Operations and Maintenance

- o Maintain roofs
- o Maintain downspouts and cap flashing
- o Provide weather-stripping/air-sealing
- o Change filters on air handling and rooftop package units monthly
- o Tighten belts on exhaust fans and blowers every three to six months

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Township of Cranford. Based on the requirements of the LGEA program, Township of Cranford must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $3,234 (or 25% of $12,938).

Financial Incentives and Other Program Opportunities

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

Table 3: Next Steps for the Community Center building

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Install five (5) lighting day light sensors	Smart Start, Direct Install
Install one (1) new CFL fixture	N/A
Install two (2) VendingMiser™ devices on refrigerated vending machines	N/A
Install one (1) SnackMiser™ device on a vending machine	N/A
Install twenty-eight (28) lighting occupancy sensors	Smart Start, Direct Install
Install eight (8) Demand-Controlled Ventilation Systems	N/A

There are various incentive programs that the Township of Cranford could apply for that could help lower the cost of installing the ECMs. For the Community Center building, and contingent upon available funding, SWA recommends the following incentive programs:

- **Direct Install 2010 Program**: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.
- **Smart Start**: Most of energy savings equipment and design measures have moderate incentives under this program.
- **Renewable Energy Incentive Program**: Receive up to $0.75/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by PV renewable energy, receive a credit between $475 and $600.
- **Utility Sponsored Programs**: See available programs with PSE&G http://www.pseg.com/environment2008/wyd/community/community.jsp
- **Energy Efficiency and Conservation Block Grant Rebate Program**: Provides up to $20,000 per local government toward energy saving measures; http://njcleanenergy.com/EECBG

Please refer to Appendix F for further details.

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms and libraries, 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 Community Center building at 220 Walnut Ave, Cranford, NJ 07016. The process of the audit included a facility visit on September 9, 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 Township of Cranford to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Community Center building.

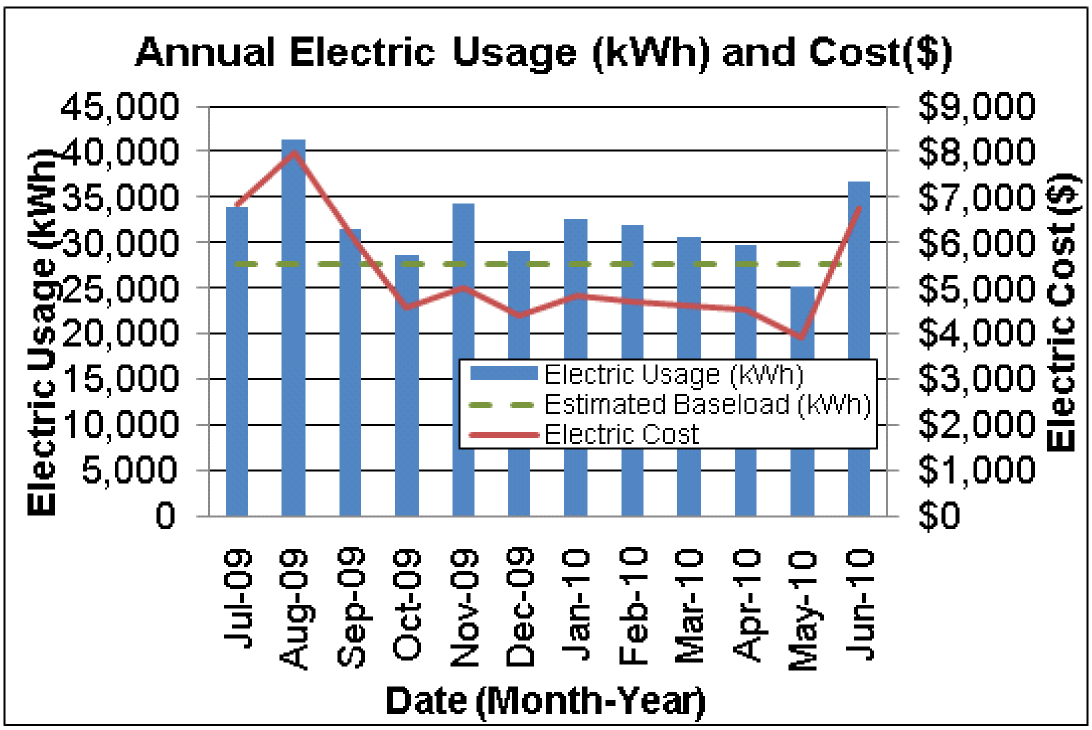
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

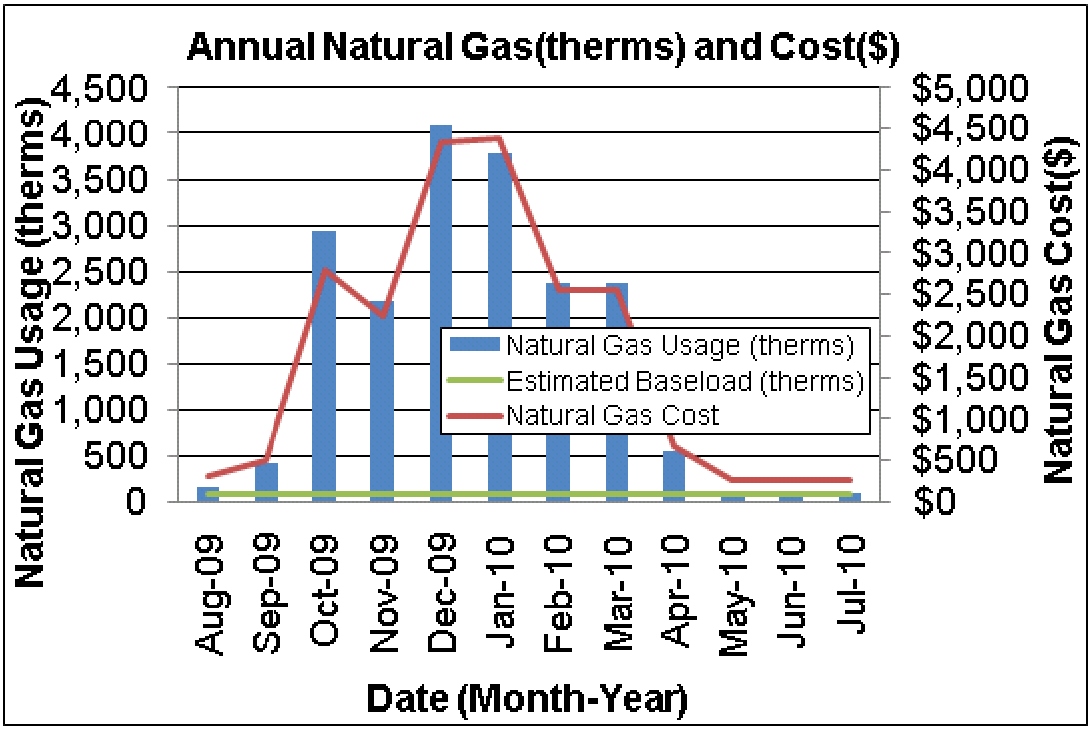
Electricity - The Community Center building is currently served by one electric meter. The Community Center building currently buys electricity from PSE&G at **an average aggregated rate of $0.167/kWh**. The Community Center building purchased **approximately 385,730 kWh, or $64,396 worth of electricity,** in the previous year. The average monthly demand was 91.2 kW and the annual peak demand was 115.2 kW.

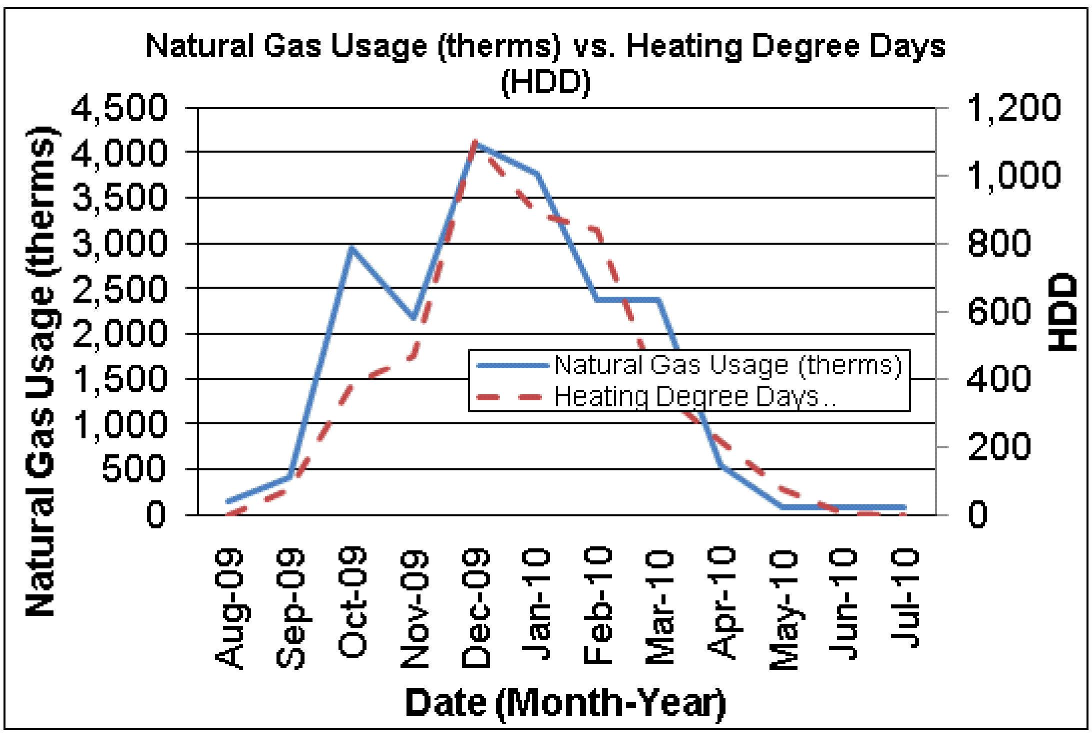
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base-load or minimum electric usage required to operate the Community Center building.



Natural gas - The Community Center building is currently served by one meter for natural gas. The Community Center building currently buys natural gas from Elizabethtown Gas at **an average aggregated rate of $1.097/therm**. The Community Center building purchased **approximately 19,653 therms, or $21,555 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 base-load or minimum natural gas usage required to operate the Community Center building.

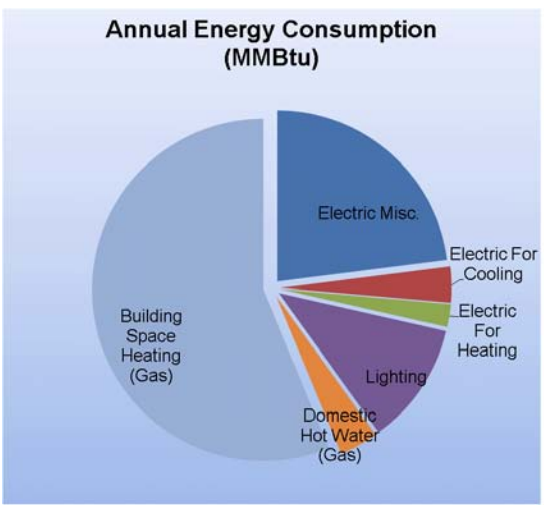


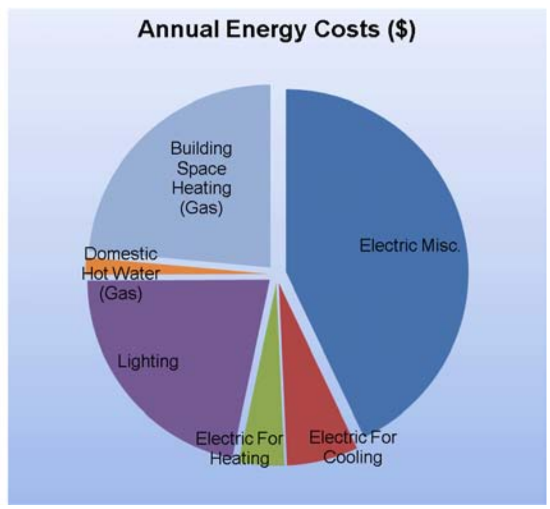


The previous chart shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the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

The following graphs, pie charts, and table show energy use for the Community Center building based on utility bills for the 12 month period. Note: electrical cost at $49MMBtu of energy is more than four times as expensive as natural gas at $11/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	755	23%	$36,916	43%	49
Electric For Cooling	111	3%	$5,450	6%	49
Electric For Heating	71	2%	$3,463	4%	49
Lighting	380	12%	$18,567	22%	49
Domestic Hot Water (Gas)	120	4%	$1,317	2%	11
Building Space Heating (Gas)	1,845	56%	$20,238	24%	11
Totals	3,282	100%	$85,951	100%	
Total Electric Usage	1,316	40%	$64,396	75%	49
Total Gas Usage	1,965	60%	$21,555	25%	11
Totals	3,282	100%	$85,951	100%	

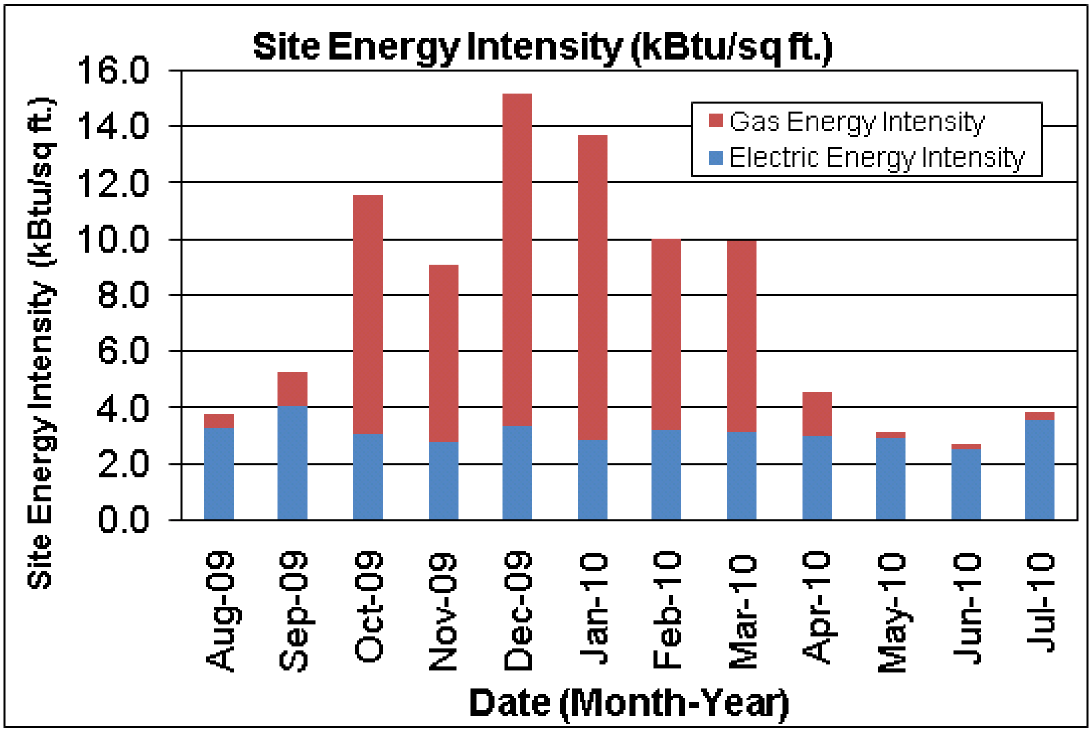




Energy benchmarking

SWA has also entered energy information about the community center building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This facility is compared to "Other-recreation" building type for energy use. Because it is an "Other" space type, there is no rating available. Consequently, the community center is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 94 kBtu/ft^2-yr compared to the national average of a recreation building consuming 65 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance.



Per the LGEA program requirements, SWA has assisted the Township of Cranford to create an ENERGY STAR® Portfolio Manager account and share the Community Center 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 Township of Cranford (user name of "townshipofcranford" with a password of "townshipofcranford") and TRC Energy Services (user name of "TRC-LGEA").

Tariff analysis

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

Tariff analysis is performed to determine if the rate that a building is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used for heating. 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 for cooling.

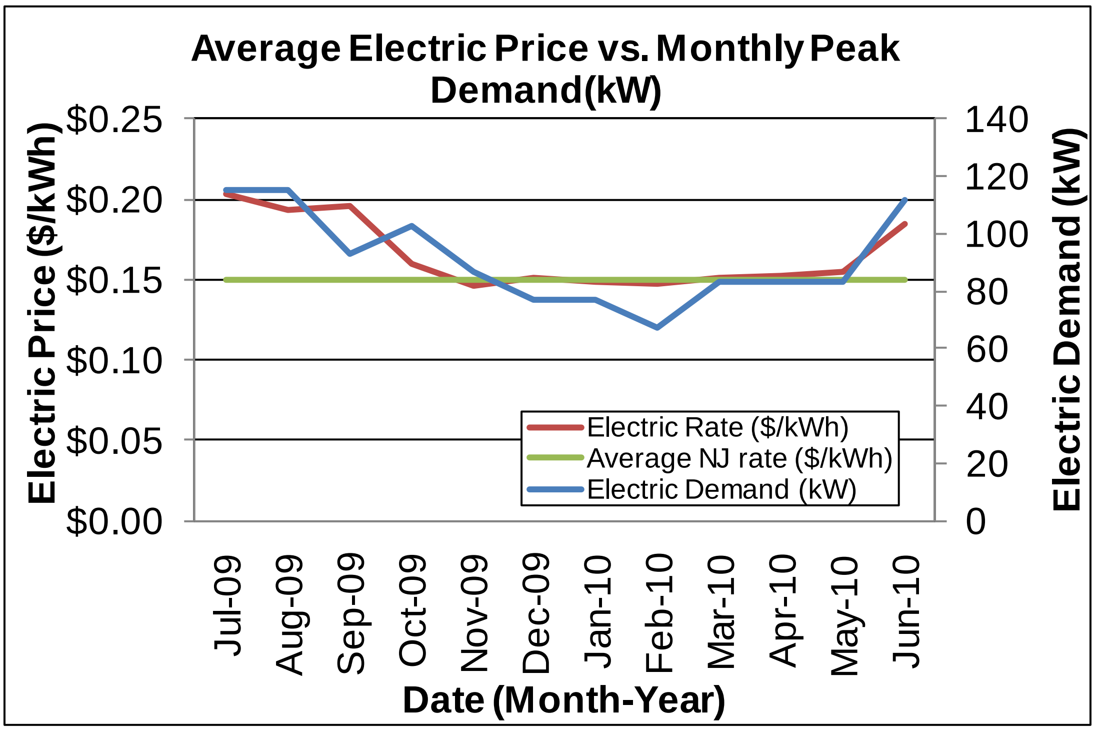
The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the building is paying a general service rate for natural gas. Demand charges are not broken out in the bill. Thus the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

Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

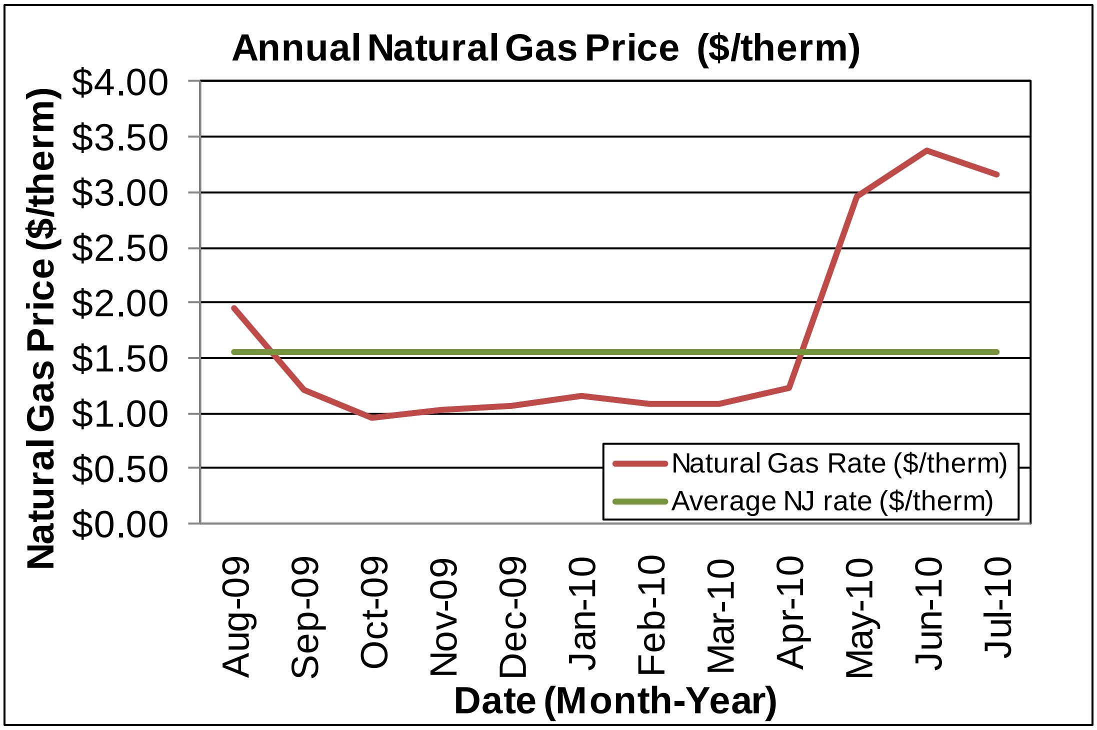
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Community Center building pays a rate of $0.167/kWh. The Community Center building annual electric utility costs are $6,537 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 28% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Community Center building pays a competitive rate of $1.097/therm. Natural gas bill analysis shows fluctuations up to 52% 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 Community Center 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 Community Center building. Appendix C contains a complete list of third-party energy suppliers for the Cranford 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 the visit from SWA on September 9, 2010, the following data was collected and analyzed.

Building Characteristics

The two story (over full basement) 34,782 square foot Community Center building was built in 2000. The Community Center building contains classrooms, a gymnasium, game room, fitness center, kitchen, meeting and conference rooms, administrative offices, a mechanical room, and bathrooms.


North East Façade and Main Entrance


North West Façade


South West Façade

Building Occupancy Profiles

There are approximately 5 full time employees and 3 part time employees in the building at any given time. There are approximately 20-100 Township residents utilizing the building throughout daytime or evening hours for town events, meeting groups, fundraisers, or classes. The YMCA currently rents space in the building for pre-school. The Community Center building is in use weekdays from 8am through 3pm or 6pm (depending on the event calendar). Occupancy hours vary seasonally and per scheduled event. The building is typically closed on Saturdays during the summer and Sundays year round.

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. However, a complete and thorough analysis of the building envelope was still completed as the construction plans and information provided were able to address any possible issue that the IR imagery could have discovered.

Exterior Walls

The exterior walls consist of 8" Concrete Masonry Units (CMU) and 3" of rigid wall insulation. The exterior façade is a standard 4" brick veneer, 8" ground face scored CMU, or ground face monumental CMU. The interior walls are painted gypsum board or painted CMU. Foundation walls are poured concrete with 2" rigid insulation on concrete perimeter footings.

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades. Ground vegetation should be installed minimally 24 inches from the exterior walls in order to prevent root growth into foundation walls, for proper drainage and sun exposure. Regular maintenance should be performed to ensure drainage is effective.

Ground vegetation close to exterior wall surfaces (L.) and typical exterior wall façade (R.)

North East Façade – typical exterior walls

Roof

Approximately one-fifth of the building's roof is blue standing seam metal roofing on light gauge steel rafters. The rest of the roof surface is a flat and parapet type over steel decking, with a dark-colored EPDM single membrane finish. There is 2-3" of rigid insulation between the membrane and decking, tapered at scuppers.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good, age-appropriate condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues. No roof leaks or damage were mentioned at the time of the audit.



Standing seam metal roof and single ply EPDM roof membrane

Base

The building's base is composed of a full below-grade basement with a slab floor with poured concrete foundation walls and no detectable slab edge/perimeter insulation.

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 double pane, fixed or double hung, aluminum framed windows with interior mini blinds. All windows are tinted, low-e double pane fixed glass storefront panels, aluminum framed.

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



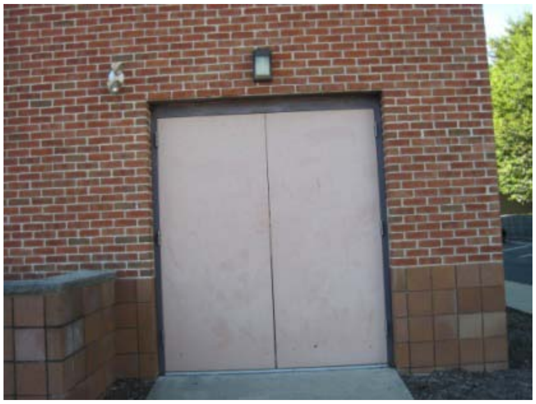
Typical Double-glazed window

Caulking around perimeter of window framing in good condition

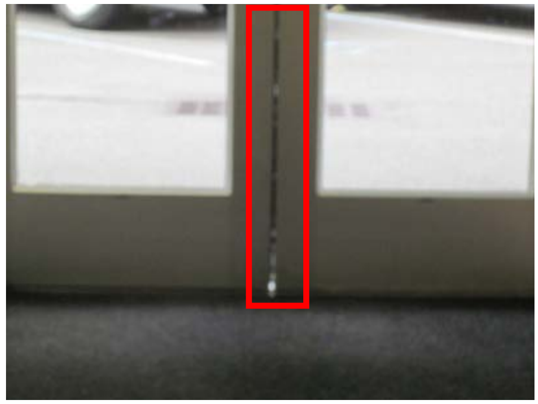
Exterior doors

The building contains two different types of exterior doors. The front and back entrance doors are glass aluminum frame exterior doors, with low-e tinted glass. These doors are original and in good condition. The rest of the doors are metal, insulated doors in age appropriate condition.

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



Two typical door types in good condition


Exterior door in need of weather-stripping

Building air-tightness

Overall, the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

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

Mechanical Systems

Heating Ventilation Air Conditioning

The entire community center is both heated and cooled by a combination of systems. Cooling for the first floor general areas is provided a combination of two interior basement ceiling mounted air handler units. Each air handler unit is paired with a roof mounted condenser unit. Cooling for the elevator machine room is provided by a direct expansion split system unit with interior evaporator unit and roof mounted condenser. Three roof mounted packaged units with direct expansion sections cool the gymnasium, second floor general areas and audio visual room.

Heating is primarily supplied by two hot water boilers located in the basement. They supply hot water to four hot water unit heaters which service the basement. Heating for the gymnasium, second floor general areas and audio visual room is supplied by three roof mounted packaged air handler units that have a gas furnace in addition to their direct expansion cooling sections along with their associated distributive ducts. The preschool is also heated by electric radiant ceiling panels.

Ventilation for the building is provided by the rooftop packaged units which bring in fresh air to their respective distributive ducts and five roof mounted exhausted fans.

A comprehensive Equipment List can be found in Appendix A.

Equipment

Cooling in the basement is provided a combination of two interior ceiling mounted air handler units. Each air handler unit is paired with a roof mounted condenser unit. They are sized at 40 tons and 20 tons with respective efficiencies of an 11.5 EER for the 40 ton unit, and a SEER of 10 for the 20 ton unit. Both units were installed in 2000, utilize R-22 refrigerant and have 33% of their useful life remaining. Cooling for the elevator machine room is provided by a direct expansion split system unit with interior evaporator unit and roof mounted condenser. It is a 12,700 BTU/Hr. rated unit with an efficiency of 10.4 EER, utilized R-22 refrigerant and has 33% of its useful life remaining as it was installed in 2000. Three roof mounted packaged units with direct expansion sections cool the gymnasium, second floor general areas and audio visual room. These units were all installed in 2000, utilize R-22 refrigerant, have 33% of their useful life remaining and varies in size between 13 – 36 tons.

The primary heating system in the building is two gas fired boilers used to supply hot water to various hydronic heating distribution systems. Both boilers are sized for an output capacity of 788.6 MBH and efficiency of 78%. These units were both observed to be in good age appropriate condition, were installed in 2000 and have 50% of their useful life remaining. Heat is also supplied by the three packaged rooftop units which have gas fired furnace sections with 80% efficiencies that are used to heat the gymnasium, second floor general areas and audio visual room. The preschool radiant ceiling panels are rated at 375 W each and are in good operating condition.

The Community Center building is provided ventilation by outside air intake louvers on the rooftop units and air handlers. Five bathroom and kitchen exhaust fans also help ventilate the building. All building exhaust fans are in satisfactory condition and have 33% remaining estimated service lives.

Distribution Systems

A typical rooftop unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through the furnace section before the conditioned air is distributed into the building spaces. The DX system is only active in the cooling season. In between seasons only the blower will be active to provide fresh air to the building.

The Community Center building RTUs and air handlers distribute conditioned air to associated spaces via a ductwork system and diffusers. The ducts are insulated on the inside for heat and noise abatement. The air handlers and RTUs are controlled via thermostats that satisfy the temperature settings of the spaces they serve.

Heating hot water also distributed throughout the basement to four hot water unit heaters. All four unit heaters are ceiling mounted, are rated at capacities of 70 MBH, equipped with 1/8 HP motors and were installed in 2000 with 50% of their useful lives remaining. There are also variable air volume mixing boxes throughout the building that are operated by an air bypass system. The variable frequency drives were installed but have been bypassed as they kept tripping due to electric system faults.

Controls

The building is equipped with a building management system which operates the boiler, unit heaters, roof top units, air handlers in the basement and variable air volume boxes. The system is operated by a third party company Enertech, and is used to maintain a constant temperature of 67^{o}F year round with a 2^{o}F deadband. The elevator machine room split system is operated by its own thermostat and manual controls. Each air handler and RTU controls are based on its associated room thermostat and setting, duct temperature sensors and adjusts for outdoor temperature. Based on this information supply and exhaust fans and dampers, furnace and boiler burners are electronically activated, controlled and adjusted. The variable air volume boxes are installed with bypass dampers and pressure controllers at each units discharge and return. These boxes are used in conjunction with both air handler units (AHU-1 and AHU-2) and all packaged rooftop units except for RTU-1 which services the gymnasium. Additionally, all of the variable air volume boxes and their respective air handlers and packaged rooftop units are equipped with variable control units, however, they are currently non-functional.

Domestic Hot Water

The domestic hot water (DHW) for the Community Center building is provided by a natural gas heated Sate Industries domestic hot water heater with 75 gal storage tank. It has an estimated efficiency of 78%. This DHW heater appears in satisfactory condition and has 33% its estimated service life.

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 Community Center building currently contains a variety of fixtures with the most common being electronically ballasted T8 lamped fixtures. There were also several self ballasted compact fluorescent lamps and a few isolated instances of self ballasted incandescent fixtures and magnetically ballasted T12 lamp fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

SWA analyzed LED lighting upgrades but due to the presence of the electronically ballasted fixtures with T8 lamps, such upgrades were determined to not be cost effective and presented additional difficulties regarding lighting density, quality, and an inability to utilize the current fixtures and troffers.

Plenty of natural day lighting without need of artificial lighting

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be compact fluorescent fixtures. Exterior lights are on, switches, timers, and photocell sensors.

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.

Installed in the community center are two newer energy efficient refrigerators, one of which is a large residential sized General Electric unit and the other is a compact Danby manufactured unit. There are also two older model inefficient refrigerated vending machines installed as well as an older model non-refrigerated snack vending machine.

Existing vending machines

Elevators

The Community Center building is a two story building with an Otis Elevator Co. submerged hydraulic passenger elevator with a 20 HP motor, and 72% efficiency.

Other electrical systems

There are not currently any significant energy-impacting electrical systems installed at the Community Center building, however, there is a 100 kW, 125 kVA generator. See the equipment list in Appendix A for more detail. The incoming power main transformer is maintained by PSE&G and it appears in satisfactory condition.

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 is not a renewable system installed at the Community Center 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 Community Center building is a good candidate for a 30 kW Solar Panel installation. See ECM#10 for details.

Solar Thermal Collectors

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

Wind

The Community Center building is not a good candidate for a wind power generation due to unfavorable wind conditions in this area of New Jersey.

Geothermal

The Community Center building is not a good candidate for a geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have 20% to 80% remaining useful lives.

Combined Heat and Power

The Community Center building is not a good candidate for a 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	Install five (5) lighting day light sensors
2	Install one (1) new CFL fixture
3	Install two (2) VendingMiser™ devices on refrigerated vending machines
4	Install one (1) SnackMiser™ device on a vending machine
5	Install twenty-eight (28) lighting occupancy sensors
6	Install eight (8) Demand-Controlled Ventilation Systems
7	Building Management System and VFD Controls Upgrade
ECM#	**Description of Recommended 5-10 Year Payback ECMs**
8	Install one (1) 15 HP NEMA premium efficiency motor
9	Install six (6) new bi-level lighting fixtures
10	Install two (7.5) 15 HP NEMA premium efficiency motors
12	Install one (1) 5 HP NEMA premium efficiency motor
13	Install two (2) 3 HP NEMA premium efficiency motors
14	Replace one (1) gas fired domestic hot water heater with two (2) ENERGY STAR® qualified gas fired tankless domestic hot water heaters
15	Replace one (1) hot water space heating boiler with an ENERGY STAR® gas fired condensing model
ECM#	**Description of Recommended Renewable ECMs**
11	Install a 30 kW solar photovoltaic rooftop system

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

ECM#1: Install five (5) lighting day light sensors

During the field audit, SWA completed a building lighting inventory (see Appendix B). SWA observed that the existing lighting has minimal to no control via day lighting sensors. SWA identified an area that could benefit from the installation of a day lighting sensor. SWA recommends installing one day lighting sensor where lighting fixtures are mounted above windows and where the payback on savings is justified. Ceiling mounted day light sensors measure the ambient light reflected from surfaces ranging from 0 to 6,500 foot candles. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $975 (Includes $600 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
1,100	125	975	8,750	1.8	0	0.9	0	1,461	15	21,918	0.7	2148	143	150	15,716	15,666

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy - Day lighting sensors, wall or ceiling mounted ($25 per control) - Maximum incentive amount is $125.

Please see Appendix F for more information on Incentive Programs.

ECM#2: Install one (1) new CFL fixture

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

Installation cost:

Estimated installed cost: $9 (Includes $4 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
9	0	9	28	0.0	0	0.0	4	9	5	45	1.0	401	80	97	32	49

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#3: Install two (2) VendingMiser™ devices on refrigerated vending machines

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

Installation cost:

Estimated installed cost: $398 (includes $40 of labor)
Source of cost estimate: www.usatech.com and 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
398	0	398	728	0.2	0	0.1	0	122	5	608	2.5	104	21	30	256	1,303

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#4: Install one (1) SnackMiser™ device on a vending machine

Energy vending miser devices are now available for conserving energy used by beverage vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

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

Installation cost:

Estimated installed cost: $99 (includes $20 of labor)
Source of cost estimate: www.usatech.com and 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
99	0	99	175	0.0	0	0.0	0	29	5	146	3.4	48	10	15	34	313

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

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#5: Install twenty-eight (28) lighting occupancy sensors

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

Installation cost:

Estimated installed cost: $5,600 (Includes $3,360 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
6,160	560	5,600	9,208	1.9	0	0.9	0	1,538	15	23,067	3.6	312	21	27	12,495	16,487

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy - Occupancy sensors, wall mounted ($20 per control) - Maximum incentive amount is $560.

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install eight (8) Demand-Controlled Ventilation Systems

On the day of the site visit, SWA observed that there were not any air flow controls based on occupancy. SWA recommends that carbon dioxide sensors be installed (in return air ducts) in the larger spaces to sense occupancy and improve Indoor Air Quality (IAQ). Signals from these sensors need to be taken back to the HVAC air flow controls for programming to regulate the amount of cooling and heating for these spaces and vary air flows according to occupancy. Thus, many a time when these spaces are sparsely occupied, savings will be realized in the heating and cooling of these spaces, by bringing into the spaces the right amount of fresh air (rather than too much unconditioned air).

Demand controlled ventilation (DCV) is the process of automatically modulating the rate of outdoor air supply (i.e., rate of ventilation) as the "demand" or need for ventilation varies. The objective is to keep ventilation rates at or above design specifications and code requirements and also to save energy by avoiding excessive ventilation rates, as energy is normally required to heat, cool, and dehumidify the ventilation air supplied to buildings. The need for ventilation is increased when the rate of air pollutant generation from indoor sources is high. People and their activities are among the important indoor pollutant sources and in many indoor spaces occupant density is highly variable. Thus, DCV is most often implemented in spaces with sometimes high and temporally variable occupant density, for example meeting rooms and theatres. In the usual application of DCV, ventilation rates are automatically modulated based on measured indoor concentrations of carbon dioxide (CO2), as CO2 is emitted by people as a metabolic by product and more easily measured than other air pollutants resulting from occupancy. When the indoor occupant density is increased, the indoor concentration of CO2 increases, unless the ventilation rate also increases. Carbon dioxide is not generally considered a directly harmful air pollutant at the concentrations found indoors - rather the concentration of CO2 is considered a proxy for the concentration of a variety of other odorous or potentially harmful pollutants emitted by people or their activities. A typical DCV system is designed to modulate ventilation rates over time so that indoor carbon dioxide concentrations do not exceed a set point, or target, value. The set point CO2 concentration is typically between 800 and 1,000 parts per million with outside CO2 levels typically at low concentrations of around 400 to 450 ppm. SWA considered DCV opportunities for the four building package units.

Building codes require that a minimum amount of fresh air be provided to ensure adequate air quality. To comply, ventilation systems often operate at a fixed rate based on an assumed occupancy (e.g., 15 cfm per person multiplied by the maximum design occupancy). The result is there often is much more fresh air coming into buildings than is necessary. That air must be conditioned, resulting in higher energy consumption and costs than is necessary with appropriate ventilation. ANSI/ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality, sets minimum ventilation rates and other requirements for commercial and institutional buildings, besides state and local building codes.

Installation cost:

Estimated installed cost: $9,600 (includes $2,880 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
9,600	0	9,600	13,314	2.8	106	1.6	0	2,340	12	28,077	4.1	192	16	22	13,414	25,007

Assumptions: SWA assumed thermal savings based on corresponding changes in the heating and cooling loads based on ventilation calculated using the billing analysis. In order to estimate savings for this measure, SWA calculated energy reductions equivalent to the ratio of the energy saved to the total heating and cooling used by the size of the space(s), occupancy and utilization according to known schedules (in view that some of the spaces are rarely used at the full designed capacity)

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: Building Management System and VFD Controls Upgrade

On the day of the site visit, SWA observed that the existing BMS (building management system) no longer has functioning night-time setback capabilities. Reportedly, the system daytime setting is permanently set all year long to 67°F with a 2°F dead band twenty-four hours a day, which is leading to unnecessary cooling and heating at night, and during the shoulder heating and cooling seasons. SWA also recommends that a control workstation be installed inside the facility and that control of the BMS to be in the hands of actual building staff instead of Enertech so that the BMS at any time can be monitored and modified in reaction to actual building conditions. As part of this measure, SWA has included the estimated cost for a 100 hour training program for the building staff and monthly visits from the training provider, or BMS Company for troubleshooting and support. SWA also recommends that all of the currently nonfunctional variable control units be repaired or replaced as necessary and integrated with the BMS. As part of the BMS upgrade the building staff should also update the current occupancy schedule and ideal temperature settings for thermal comfort.

Installation cost:

Estimated installed cost: $30,000 (estimated labor cost $15,000)
Source of cost estimate: Published and established costs; similar projects

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
30,000	0	30,000	30,858	6.4	983	5.9	0	6,232	10	62,316	4.8	108	11	16	22,619	66,087

Assumptions: SWA assumed an estimated annual savings of 8% of the buildings total electric usage and 5% of the buildings total natural gas usage.

Rebates/financial incentives:

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

Please see Appendix F for more information on Incentive Programs.

ECM#8: Install one (1) 15 HP NEMA premium efficiency motor

Electric motors have a significant impact on the total energy operating costs in a building, and may vary widely in terms of energy efficiency. The NEMA Premium Motors energy efficiency program was established to assist users to optimize motor systems efficiency in light of power supply and utility deregulation issues. NEMA Premium motors help to optimize systems thereby reducing electrical consumption and reducing pollution associated with electrical power generation. SWA noted that the existing fan motor on AHU-1 is rated at 15 and assumed that is of standard efficiency from information conveyed by building staff. SWA recommends replacing this motor with premium efficiency motor.

Installation cost:

Estimated installed cost: $1,635 (estimated labor cost $560)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,680	45	1,635	1,652	0.3	0	0.2	0	276	12	3,311	5.9	102	9	13	1,079	2,958

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The New Jersey Clean Energy motors tech tool was used to estimate installed cost and energy savings, it can be found at http://www.njcleanenergy.com/files/file/Tech-Tools/MotorTechTool%20-%20final%205-4-10.xlsm

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor); for 7.5 hp motor - $90/motor, for 10 hp motor - $100/motor, for 25 hp motor - $130/motor, and for 30 hp motor - $150/motor; maximum incentive available is $45.

Please see Appendix F for more information on Incentive Programs.

ECM#9: Install six (6) new bi-level lighting fixtures

On the day of the site visit, SWA completed a lighting inventory of the Cranford Community Center (see Appendix B). The community center contains six stairwell T8 fluorescent lighting fixtures that are operated 12 hours per day. New technology called bi-level lighting, combines fluorescent lighting fixtures with an occupancy sensor. These efficient light fixtures operate at a minimal light level in order to meet code and safety requirements and power up to a higher level when any motion is detected in the stairwells. The Cranford Community Center would be an appropriate application for these fixtures since the stairwells are rarely used.

Installation cost:

Estimated installed cost: $850 (includes $570 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
1,000	150	850	825	0.2	0	0.1	0	138	15	2,066	6.2	143	10	14	771	1,477

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 – Bi-level lighting sensors ($25 per control*
- *Maximum Incentive Available - $150)*

Please see Appendix F for more information on Incentive Programs.

ECM#10: Install two (7.5) 15 HP NEMA premium efficiency motors

Electric motors have a significant impact on the total energy operating costs in a building, and may vary widely in terms of energy efficiency. The NEMA Premium Motors energy efficiency program was established to assist users to optimize 2 is motor systems efficiency in light of power supply and utility deregulation issues. NEMA Premium motors help to optimize systems thereby reducing electrical consumption and reducing pollution associated with electrical power generation. SWA noted that the existing fan motors on RTU # 2 are rated at 7.5 HP and assumed it to be of standard efficiency from information conveyed by building staff. SWA recommends replacing these motors with premium efficiency motors.

Installation cost:

Estimated installed cost: $1,814 (estimated labor cost $630)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,904	90	1,814	1,752	0.4	0	0.2	0	293	12	3,511	6.2	94	8	12	1,064	3,137

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The New Jersey Clean Energy motors tech tool was used to estimate installed cost and energy savings, it can be found at http://www.njcleanenergy.com/files/file/Tech-Tools/MotorTechTool%20-%20final%205-4-10.xlsm

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor); for 7.5 hp motor - $90/motor, for 10 hp motor - $100/motor, for 25 hp motor - $130/motor, and for 30 hp motor - $150/motor; maximum incentive available is $90.

Please see Appendix F for more information on Incentive Programs.

ECM#11: Install a 30 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 best available incentives and 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 30 kW system needs approximately 131 panels which would take up 2,293 square feet. The price of a 30 kW system is $165,000, and the payback comes to 7.0 years. SWA considered the 30kW option because of lower capital investment cost due to available incentives.

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 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 Township of Cranford 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 Township of Cranford should include these costs in the financial analysis of the project.

30 kW System - Installation cost:

Estimated installed cost: $187,500 (includes $ 75,000 of labor)
Source of cost estimate: Similar projects

30 System - Economics (with incentives):

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
210,000	22,500	187,500	35,400	30	0	3.5	0	26,910	25	672,748	7.0	259	10.3	12.1	155,293	63,384

30 kW System - Cash flow:

Annual Solar PV Cost Savings Breakdown

Rated Capacity (kW)	30.0
Rated Capacity (kWh)	35,400
Annual Capacity Loss	0%

Year	kWh Capacity	Installed Cost	Incentives	Electric Savings ($)
0		$210,000	$22,500	
1	35,400		$21,000	$5,910
2	35,400		$21,000	$5,910
3	35,400		$21,000	$5,910
4	35,400		$21,000	$5,910
5	35,400		$21,000	$5,910
6	35,400		$21,000	$5,910
7	35,400		$21,000	$5,910
8	35,400		$21,000	$5,910
9	35,400		$21,000	$5,910
10	35,400		$21,000	$5,910
11	35,400		$21,000	$5,910
12	35,400		$21,000	$5,910
13	35,400		$21,000	$5,910
14	35,400		$21,000	$5,910
15	35,400		$21,000	$5,910
16	35,400		$0	$5,910
17	35,400		$0	$5,910
18	35,400		$0	$5,910
19	35,400		$0	$5,910
20	35,400		$0	$5,910
21	35,400		$0	$5,910
22	35,400		$0	$5,910
23	35,400		$0	$5,910
24	35,400		$0	$5,910
25	35,400		$0	$5,910
	kWh	Cost	Saving	
Lifetime Total	**885,000**	**($210,000)**	**$337,500**	**$147,748**

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 $0.75 / watt Solar PV application for systems 30 kW or less. Incentive amount for this application is $22,500 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 $21,000 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

Please see Appendix F for more information on Incentive Programs.

ECM#12: Install one (1) 5 HP NEMA premium efficiency motor

Electric motors have a significant impact on the total energy operating costs in a building, and may vary widely in terms of energy efficiency. The NEMA Premium Motors energy efficiency program was established to assist users to optimize motor systems efficiency in light of power supply and utility deregulation issues. NEMA Premium motors help to optimize systems thereby reducing electrical consumption and reducing pollution associated with electrical power generation. SWA noted that the existing fan motor on AHU-2 is rated at 5 HP and assumed to be of standard efficiency from information conveyed by building staff. SWA recommends replacing this motor with premium efficiency motor.

Installation cost:
Estimated installed cost: $711 (estimated labor cost $252)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
765	54	711	572	0.1	0	0.1	0	96	12	1,146	7.4	61	5	8	229	711

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The New Jersey Clean Energy motors tech tool was used to estimate installed cost and energy savings, it can be found at http://www.njcleanenergy.com/files/file/Tech-Tools/MotorTechTool%20-%20final%205-4-10.xlsm

Rebates/financial incentives:
NJ Clean Energy - Premium three-phase motors ($45-$700 per motor); for 3 hp motor motor - $54/motor, for 5 hp motor - $54/motor, 7.5 hp motor - $90/motor, for 10 hp motor - $100/motor, for 25 hp motor - $130/motor, and for 30 hp motor - $150/motor; maximum incentive available is $54.

Please see Appendix F for more information on Incentive Programs.

ECM#13: Install two (2) 3 HP NEMA premium efficiency motors

Electric motors have a significant impact on the total energy operating costs in a building, and may vary widely in terms of energy efficiency. The NEMA Premium Motors energy efficiency program was established to assist users to optimize motor systems efficiency in light of power supply and utility deregulation issues. NEMA Premium motors help to optimize systems thereby reducing electrical consumption and reducing pollution associated with electrical power generation. SWA noted that the existing fan motors on RTU # 1 & RTU # 3 are rated at 3 HP and assumed to be of standard efficiency from information conveyed by building staff. SWA recommends replacing these motors with premium efficiency motors.

Installation cost:
Estimated installed cost: $1,121 (estimated labor cost $406)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,229	108	1,121	878	0.2	0	0.1	0	147	12	1,760	7.6	57	5	8	321	1,572

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The New Jersey Clean Energy motors tech tool was used to estimate installed cost and energy savings, it can be found at http://www.njcleanenergy.com/files/file/Tech-Tools/MotorTechTool%20-%20final%205-4-10.xlsm

Rebates/financial incentives:
NJ Clean Energy - Premium three-phase motors ($45-$700 per motor); for 3 hp motor motor - $54/motor, for 5 hp motor - $54/motor, 7.5 hp motor - $90/motor, for 10 hp motor - $100/motor, for 25 hp motor - $130/motor, and for 30 hp motor - $150/motor; maximum incentive available is $108
Please see Appendix F for more information on Incentive Programs.

ECM#14: Replace one (1) gas fired domestic hot water heater with two (2) ENERGY STAR® qualified gas fired tankless domestic hot water heaters

During the field audit, SWA inspected the old gas fired domestic hot water heater on site which are not ENERGY STAR® rated or a condensing or tankless model. This boiler is operating at 60% of its remaining useful life with an efficiency of 78%. SWA recommends replacing this heater with two ENERGY STAR® qualified gas fired tankless domestic hot water heaters to operate in a staged manner.

Demand water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses associated with storage water heaters. Although gas-fired demand water heaters tend to have higher flow rates than electric ones, they can waste energy if they have a constantly burning pilot light. This can sometimes offset the elimination of standby energy losses when compared to a storage water heater, therefore SWA recommends a model with an intermittent ignition device instead of a standing pilot light to achieve the maximum amount of energy savings.

SWA recommends installing two ENERGY STAR® qualified gas fired tankless models in a staged manner so that the second unit can combine with the first to meet the buildings hot water load during peak demand. The existing unit has an input of 75 gallons and 120 MBH. Both replacements are recommended with a capacity of 100 MBH each.

Installation cost:

Estimated installed cost: $3,400 (includes $1,200 of labor)
Source of cost estimate: Manufacturer and Store established costs, NJ Clean Energy Program, Similar Projects, and RS Means

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
3,400	400	3,000	0	0.0	360	1.0	0	395	15	5,924	7.6	97	6	10	1,647	3,968

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis. SWA assumed 30% hot water gas usage savings due to the installation of the tankless system and an estimated cost of $1,700 per unit.

Rebates/financial incentives:

- NJ Clean Energy - Natural gas-fired water heaters with a capacity greater than fifty gallons and less than 300 MBH ($2.00 per MBH)
- Maximum Incentive Amount $400

Please see Appendix F for more information on Incentive Programs.

ECM#15: Replace one (1) hot water space heating boiler with an ENERGY STAR® gas fired condensing model

During the field audit, SWA inspected the old boilers on site which are not ENERGY STAR® rated or a condensing model. These boilers are operating at 50% of their remaining useful life. SWA recommends replacing one of theses boilers with an ENERGY STAR® gas fired condensing model boiler with a higher thermal efficiency to operate as a lead boiler. The remaining existing boiler can remain as back-up.

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 a 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. 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.

SWA recommends installing the ENERGY STAR® gas fired condensing model as the lead boiler and leaving one of the two existing Raypak hot water space heating boilers as a back up. The existing unit has an input of 961.7 MBH, output of 788.6 MBH and estimated efficiency of 78% and the proposed unit should have an equivalent capacity.

Installation cost:

Estimated installed cost: $16,816 (includes $4,867 of labor)
Source of cost estimate: Manufacturer and Store established costs, NJ Clean Energy Program, Similar Projects, and RS Means

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
18,497	1,681	16,816	0	0	1,753	5.0	0	1,923	20	38,461	8.7	129	6	10	11,272	19,323

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

Rebates/financial incentives:

- NJ Clean Energy - Natural gas-fired water heaters with a capacity greater than fifty gallons and greater than 300 MBH but less than 1,500 MBH ($1.75 per MBH)
- Maximum Incentive Amount $961

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 Community Center 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 all existing electric cabinet unit heaters – Replace all existing cabinet units heating hot hydronic hot water cabinet unit heaters that utilize the existing space heating hot water supply provided by the boilers.

- Replace all old exhaust fans – The estimated life cycle of an exhaust fan is 10 years, replace all exhaust fans that have been in operation for longer than 10 years as they malfunction or need repair.

- Retrofit the existing roof membrane – Upgrade the existing roof membrane with an ENERGY STAR® qualified, climate zone appropriate, reflective roof membrane coating to help reduce the buildings cooling load and peak summer time electric usage while also increasing comfort.

- Replace existing electric ceiling radiant heating panels – replace all existing ceiling radiant heating panels with variable air volume boxes equipped with hot water heating coils supplied by the hot water supply from the space heating boilers. Due to the estimated payback of 14.7 years, this replacement is being recommended as a capital improvement to be implemented at the end of the life cycle of the current equipment or in the case of premature catastrophic failure. Also, as per ECM#7, building management system fixes including variable air volume boxes would provide better control of heating in the Preschool area thus obviating the need for any supplemental heating as well.

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.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly and drains are cleaned.

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

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

- Maintain exterior wall facades - SWA recommends as part of the maintenance program regularly inspecting all exterior wall assemblies, sealing wall cracks or holes and penetrations wherever necessary in order to keep insulation dry and effective.

- 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.

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

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

- 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/.

- Change filters on air handling and rooftop package units monthly to ensure efficient operation of the blowers and ensure adequate air delivery to the spaces.

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

- Inspect air handling and rooftop package units' coils for dirt buildup three to six months. These conditions should be rectified if found because they will cause inefficient operation and possibly damage to the equipment.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for Township of Cranford. Based on the requirements of the LGEA program, Township of Cranford must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $3,234 (or 25% of $12,938).

APPENDIX A: EQUIPMENT LIST – Mechanical Inventory

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Cooling	AHU-1: Air handling unit, 200/3/60, 15hp fan motor, standard efficiency, 11,525cfm, 4150 cfm OA	Basement	Trane, model MCCA025, S/N K99F15282N	Elec.	1st floor - general areas	2000	33%
Cooling	ACU-1: Condensing unit, scroll compressors, 40 tons cooling, R-22, 208/3/60, MCA192, 11.5EER	Roof	Trane, model RAUCC40EBT13 A0D0000, S/N C99F09436M	Elec.	AHU-1: 1st floor - general areas	2000	33%
Cooling	AHU-2: Air handling unit, 200/3/60, 5hp fan motor, standard efficiency, 3200 cfm, 100% OA	Basement	Trane, model MCCA008, S/N K99F12479N	Elec.	1st floor - general areas	2000	33%
Cooling	ACU-2: Condensing unit, 20 tons cooling, 208/3/60, estimated 10 SEER	Roof	Trane, nameplate N/A	Elec.	AHU-2: 1st floor - general areas	2000	33%
Heating	Hot water unit heater, 70MBH, 1740 cfm, 115/1/60, 1/8hp, Marathon Electric motor	Basement	Trane, model UHSA070W2DA AE, S/N C99F39488M	Elec.	Basement	2000	33%
Heating	Hot water unit heater, 70MBH, 1740 cfm, 115/1/60, 1/8hp, Marathon Electric motor	Basement	Trane, model UHSA070W2DA AE, S/N C99F39487M	Elec.	Basement	2000	33%
Heating	Hot water unit heater, 70MBH, 1740 cfm, 115/1/60, 1/8hp, Marathon Electric motor	Basement	Trane, model UHSA070W2DA AE, S/N C99F39490M	Elec.	Basement	2000	33%
Heating	Hot water unit heater, 70MBH, 1740 cfm, 115/1/60, 1/8hp, Marathon Electric motor	Basement	Trane, nameplate N/A	Elec.	Basement	2000	33%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip. Installed	Remaining useful life %
Heating	Hot water boiler, Category I, 961.7/788.6 MBH in/out, est. 78% eff., c/w Emerson Electric burner fan motor, 1/2hp	Basement	Raypak, model H3-0962, S/N 9911164604	Gas	Whole building	2000	33%
Heating	Hot water boiler, Category I, 961.7/788.6 MBH in/out, est. 78% eff., c/w Emerson Electric burner fan motor, 1/2hp	Basement	Raypak, model H3-0962, S/N 9911164605	Gas	Whole building	2000	33%
Heating	Pump -1: Hot water pump, 93gpm @ 35' head, 208/3/60, US Electric motor, 2hp, 1170rpm, 85.5% NEMA nom. Eff.,	Basement	Armstrong, size 4130, motor model T517A, ID#B09 01023344	Elec.	Whole building	2000	33%
Heating	Pump -2: Hot water pump, 93gpm @ 35' head, 208/3/60, US Electric motor, 2hp, 1170rpm, 85.5% NEMA nom. Eff.,	Basement	Armstrong, size 4130, motor model T517A, ID#B12 01030408	Elec.	Whole building	2000	33%
DHW	Domestic Water Heater, 75 gallon tank, 120MBH input, est. 78% eff.	Basement	State Industries, model SBF75 120 NEI, S/N E94285004	Gas	Whole building	2000	60%
Cooling	AC-1: Indoor mini split unit, 12,700 Btu/hr, 208/1/60, 12 W, R-22	Elevator Machine room	Goodman Manufacturing, model WMC12-14, S/N 990900026	Elec.	Elevator machine room	2000	33%
Cooling	ACU-4: Condensing unit, est. 1.4 tons cooling, 208/1/60, 10.4EER	Roof	Goodman Manufacturing, nameplate N/A	Elec.	AC-1: elevator machine room	2000	33%
HVAC	RTU#1: 20 tons cooling, R-22, 390/312 MBH in/out, est. 80% eff., 208/3/60, MCA90; 5550 cfm, 2600 cfm OA	Roof	Aaaon, model 26669, RK-20-2-E0-222:CFD UAA0BH00G0X, S/N 200001-AKGN00071	Gas/Elec.	Gym	2000	33%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip. Installed	Remaining useful life %
HVAC	RTU#2: 36 tons cooling, R-22, 780/624 MBH in/out, est. 80% eff., 208/3/60, MCA156; 14805cfm, 3930 cfm OA	Roof	Aaaon, model 26670, RK-30-2-F0-232:CHD UAA0BH00G0X, S/N 200001-AKGS00197	Gas/Elec.	2nd floor - general areas	2000	33%
HVAC	RTU#3: 13 tons cooling, R-22, 270/216 MBH in/out, est. 80% eff., 208/3/60, MCA64; 3100 cfm, 2430 cfm OA	Roof	Aaaon, model 26671, RK-13-2-F0-222:CFD UAA0BH00G0X, S/N 200001-AKGK00412	Gas/Elec.	2nd floor - Audio Visual room	2000	33%
Vent	EF-1: Sheet metal roof mounted mushroom type exhaust fan, 208/3/60, 1hp motor	Roof	Carnes, model VEBK18S1C1NA 20SPCX, S/N 642871 004	Elec.	Baths	2000	0%
Vent	EF-2: Sheet metal roof mounted mushroom type exhaust fan, 115/1/60, 1/6hp motor	Roof	Carnes, model VEBK10K1A1NA 20SCX, S/N 642871 001	Elec.	Baths	2000	0%
Vent	EF-5: Sheet metal wall mounted mushroom type exhaust fan, 115/1/60, 1/8hp motor	Roof	Carnes, model VWDK10J3A1NA 20SP5, S/N 642871 005	Elec.	Kitchen hood	2000	0%
Heating	Radiant ceiling panels, 208/3/60, 375W	Preschool, 1st floor	Marley Engineered Products, model ATH24248A, S/N 0302	Elec.	Preschool, 1st floor	2006	73%
Electric	Generator, 100kW, 125kVA, 3 Phase	Basement	Kohler, model 150RZ, S/N 0620080, Ford engine model LSG-875I-6005-A, S/N 19403-1-04-98	Gas	Whole building	2000	33%
Lighting	See details - Appendix B	See details - Appendix B	Electric	Library	Library	Varies	Avg - 20%

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

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	2	Classroom (200)	Recessed Parabolic	E	4'T8	21	3	32	Sw	4	345	5	2,121	2,927	C	Recessed Parabolic	4'T8	E	OS	21	3	32	3	345	5	2121	2195	0	732	732
2	2	Classroom (200)	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
3	2	Classroom (201)	Recessed Parabolic	E	4'T8	10	3	32	Sw	4	345	5	1,010	1,394	C	Recessed Parabolic	4'T8	E	OS	10	3	32	3	345	5	1010	1045	0	348	348
4	2	Classroom (205)	Recessed Parabolic	E	4'T8	6	3	32	Sw	4	345	5	606	836	C	Recessed Parabolic	4'T8	E	OS	6	3	32	3	345	5	606	627	0	209	209
5	2	Classroom (206)	Recessed Parabolic	E	4'T8	4	3	32	Sw	4	345	5	404	558	C	Recessed Parabolic	4'T8	E	OS	4	3	32	3	345	5	404	418	0	139	139
6	2	Classroom (204)	Recessed Parabolic	E	4'T8	6	3	32	Sw	4	345	5	606	836	C	Recessed Parabolic	4'T8	E	OS	6	3	32	3	345	5	606	627	0	209	209
7	2	Classroom (206)	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
8	2	Classroom closet (204)	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
9	2	Bathroom	Recessed Parabolic	E	4'T8	1	3	32	Sw	9	345	5	101	314	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	9	345	5	101	314	0	0	0
10	2	Janitor's Closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
11	2	Conference room / office	Recessed Parabolic	E	4'T8	4	3	32	Sw	4	345	5	404	558	C	Recessed Parabolic	4'T8	E	OS	4	3	32	3	345	5	404	418	0	139	139
12	2	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	16	2	32	Sw	12	345	5	1,104	4,571	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	16	2	32	12	345	5	1104	4571	0	0	0
13	2	Hallway	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
14	2	Hallway	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
15	2	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	7	2	32	Sw	12	345	5	483	2,000	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	7	2	32	12	345	5	483	2000	0	0	0
16	2	Hallway	Wall Mounted	S	Fl.	4	1	21	Sw	12	345	2	92	383	N/A	Wall Mounted	FL.	S	Sw	4	1	21	12	345	2	92	383	0	0	0
17	2	Hallway	Recessed	S	CFL	4	1	13	Sw	12	345	0	52	215	N/A	Recessed	CFL	S	Sw	4	1	13	12	345	0	52	215	0	0	0
18	2	Audio Visual room	Recessed Parabolic	E	4'T8	13	3	32	Sw	4	345	5	1,313	1,812	N/A	Recessed Parabolic	4'T8	E	Sw	13	3	32	4	345	5	1313	1812	0	0	0
19	2	Audio Visual room closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
20	2	Audio Visual room	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
21	2	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	8	2	32	Sw	12	345	5	552	2,285	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	8	2	32	12	345	5	552	2285	0	0	0
22	2	Arts & Crafts room	Recessed Parabolic	E	4'T8	7	3	32	Sw	4	345	5	707	976	C	Recessed Parabolic	4'T8	E	OS	7	3	32	3	345	5	707	732	0	244	244
23	2	Arts & Crafts room closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
24	2	Arts & Crafts room darkroom	Recessed	S	Inc	1	2	60	Sw	1	345	0	120	41	CFL	Recessed	CFL	S	Sw	1	2	20	1	345	0	40	14	28	0	28
25	2	Bathroom Women	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	345	5	202	627	C	Recessed Parabolic	4'T8	E	OS	2	3	32	7	345	5	202	470	0	157	157
26	2	Bathroom Men	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	345	5	202	627	C	Recessed Parabolic	4'T8	E	OS	2	3	32	7	345	5	202	470	0	157	157
27	2	Staircase	Recessed Parabolic	E	4'T8 U-Shaped	4	2	32	Sw	12	345	5	276	1,143	T8-BL	Recessed Parabolic	4'T8 U-Shaped	E	BL	4	2	32	0	345	5	276	666	0	477	477
28	2	Janitor's Closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
29	2	Electrical Closet	Ceiling Mounted	E	4'T8	1	2	32	Sw	1	345	5	69	24	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	1	345	5	69	24	0	0	0
30	1	Gymnasium	Ceiling Suspended	E	4'T8	24	6	32	Sw	8	345	5	4,728	13,049	N/A	Ceiling Suspended	4'T8	E	Sw	24	6	32	8	345	5	4728	13049	0	0	0
31	1	Gymnasium	Exit Sign	S	LED	5	1	5	N	24	365	1	28	241	N/A	Exit Sign	LED	S	N	5	1	5	24	365	1	28	241	0	0	0
32	1	Atrium	Wall Mounted	E	4'T8	92	2	32	Sw	12	345	5	6,348	26,281	C	Wall Mounted	4'T8	E	DL	92	2	32	9	345	5	6348	19711	0	6570	6570
33	1	Atrium	Wall Mounted	E	3'T8	28	2	25	Sw	12	345	3	1,484	6,144	C	Wall Mounted	3'T8	E	DL	28	2	25	9	345	3	1484	4608	0	1536	1536
34	1	Atrium	Wall Mounted	S	Fl.	17	1	28	Sw	12	345	3	524	2,168	C	Wall Mounted	FL.	S	DL	17	1	28	9	345	3	524	1626	0	542	542
35	1	Staircase	Ceiling Mounted	E	4'T8	2	3	32	Sw	12	345	5	202	836	T8-BL	Ceiling Mounted	4'T8	E	BL	2	3	32	0	345	5	202	489	0	348	348
36	1	Mechanical Rm	Ceiling Suspended	E	4'T8	30	2	32	Sw	9	345	5	2,070	6,427	C	Ceiling Suspended	4'T8	E	OS	30	2	32	7	345	5	2070	4821	0	1607	1607
37	1	Mechanical Rm	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
38	1	Mechanical Rm office	Ceiling Suspended	E	4'T8	4	2	32	Sw	9	345	5	276	857	C	Ceiling Suspended	4'T8	E	OS	4	2	32	7	345	5	276	643	0	214	214
39	1	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	15	2	32	Sw	12	345	5	1,035	4,285	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	15	2	32	12	345	5	1035	4285	0	0	0
40	1	Hallway	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
41	1	Team lounge 2	Recessed Parabolic	E	4'T8	4	3	32	Sw	4	345	5	404	558	C	Recessed Parabolic	4'T8	E	OS	4	3	32	3	345	5	404	418	0	139	139
42	1	Pre-school entrance	Recessed Parabolic	E	4'T8	3	3	32	Sw	4	345	5	303	418	C	Recessed Parabolic	4'T8	E	OS	3	3	32	3	345	5	303	314	0	105	105
43	1	Pre-school	Recessed Parabolic	E	4'T8	14	3	32	Sw	4	345	5	1,414	1,951	C	Recessed Parabolic	4'T8	E	OS	14	3	32	3	345	5	1414	1463	0	488	488
44	1	Pre-school closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
45	1	Game room	Recessed Parabolic	E	4'T8	4	3	32	Sw	4	345	5	404	558	C	Recessed Parabolic	4'T8	E	OS	4	3	32	3	345	5	404	418	0	139	139
46	1	Gymnasium closet	Recessed Parabolic	E	4'T8	2	3	32	Sw	1	345	5	202	70	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	1	345	5	202	70	0	0	0
47	1	Fitness Center	Recessed Parabolic	E	4'T8	12	3	32	Sw	4	345	5	1,212	1,673	C	Recessed Parabolic	4'T8	E	OS	12	3	32	3	345	5	1212	1254	0	418	418
48	1	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	12	345	5	414	1,714	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	6	2	32	12	345	5	414	1714	0	0	0
49	1	Lounge	Recessed Parabolic	E	4'T8	10	3	32	Sw	4	345	5	1,010	1,394	C	Recessed Parabolic	4'T8	E	OS	10	3	32	3	345	5	1010	1045	0	348	348
50	1	Vestibule	Recessed	S	CFL	2	2	13	Sw	12	345	0	52	215	C	Recessed	CFL	S	DL	2	2	13	9	345	0	52	161	0	54	54
51	1	Atrium	Wall Mounted	S	Fl.	2	1	21	Sw	12	345	2	46	191	C	Wall Mounted	FL.	S	DL	2	1	21	9	345	2	46	143	0	48	48
52	1	Elevator room	Ceiling Mounted	M	4'T12	1	2	40	Sw	1	345	12	92	32	N/A	Ceiling Mounted	4'T12	M	Sw	1	2	40	1	345	12	92	32	0	0	0
53	1	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	13	2	32	Sw	12	345	5	897	3,714	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	13	2	32	12	345	5	897	3714	0	0	0
54	1	Hallway	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
55	1	Kitchen	Recessed Parabolic	E	4'T8	5	3	32	Sw	8	345	5	505	1,394	C	Recessed Parabolic	4'T8	E	OS	5	3	32	6	345	5	505	1045	0	348	348
56	1	Community room	Recessed Parabolic	E	4'T8	24	3	32	Sw	8	345	5	2,424	6,690	C	Recessed Parabolic	4'T8	E	OS	24	3	32	6	345	5	2424	5018	0	1673	1673
57	1	Community room	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
58	1	Bathroom Men	Recessed Parabolic	E	4'T8	2	3	32	Sw	10	345	5	202	697	C	Recessed Parabolic	4'T8	E	OS	2	3	32	8	345	5	202	523	0	174	174
59	1	Bathroom Women	Recessed Parabolic	E	4'T8	2	3	32	Sw	10	345	5	202	697	C	Recessed Parabolic	4'T8	E	OS	2	3	32	8	345	5	202	523	0	174	174
60	1	Janitor's Closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
61	1	Janitor's Closet	Recessed Parabolic	E	4'T8	1	3	32	Sw	1	345	5	101	35	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	1	345	5	101	35	0	0	0
62	1	Office	Recessed Parabolic	E	4'T8	8	3	32	Sw	8	345	5	808	2,230	C	Recessed Parabolic	4'T8	E	OS	8	3	32	6	345	5	808	1673	0	558	558
63	1	Director's Office	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	345	5	404	1,115	C	Recessed Parabolic	4'T8	E	OS	4	3	32	6	345	5	404	836	0	279	279
64	1	Program Coordinator Office	Recessed Parabolic	E	4'T8	3	3	32	Sw	8	345	5	303	836	C	Recessed Parabolic	4'T8	E	OS	3	3	32	6	345	5	303	627	0	209	209
65	1	Director's Office	Recessed	S	CFL	4	1	19	Sw	4	345	0	76	105	N/A	Recessed	CFL	S	Sw	4	1	19	4	345	0	76	105	0	0	0
66	1	Office	Recessed	S	CFL	4	1	19	Sw	4	345	0	76	105	N/A	Recessed	CFL	S	Sw	4	1	19	4	345	0	76	105	0	0	0
67	Ext	Exterior	Recessed	S	CFL	7	2	13	Sw	10	365	0	182	664	N/A	Recessed	CFL	S	Sw	7	2	13	10	365	0	182	664	0	0	0
68	Ext	Exterior	Wall Mounted	S	CFL	5	2	13	T	10	365	0	130	475	N/A	Wall Mounted	CFL	S	T	5	2	13	10	365	0	130	475	0	0	0
69	Ext	Exterior	Wall Mounted	S	CFL	2	2	13	PC	10	365	0	52	190	N/A	Wall Mounted	CFL	S	PC	2	2	13	10	365	0	52	190	0	0	0
Totals:						508	160	1,820				257	39,845	111,291						508	160	1,780			257	39,765	92,481	28	18,783	18,810

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

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	34,782		
Average Power Cost ($/kWh)	0.1670		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	1,329	1,329	**0**
Exterior Power (watts)	364	364	**0**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	109,963	91,152	**18,810**
Lighting Power (watts)	39,481	39,401	**80**
Lighting Power Density (watts/SF)	1.14	1.13	**0.00**
Estimated Cost of Fixture Replacement ($)	9		
Estimated Cost of Controls Improvements ($)	7,425		
Total Consumption Cost Savings ($)	**3,146**		

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for NJNG 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
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
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

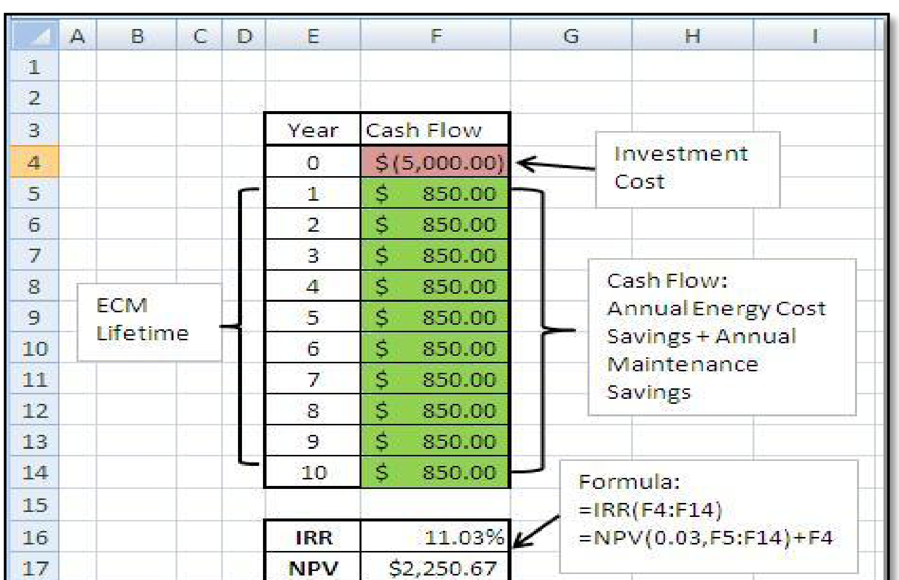
Calculation References

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

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 30kW or less, $0.75/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Cranford - Recreation Center

Building ID: 2409196
For 12-month Period Ending: May 31, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: September 20, 2010

Facility
Township of Cranford - Recreation Center
224 Walnut Avenue
Cranford, NJ 07016

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 2000
Gross Floor Area (ft²): 34,782

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,316,226
Natural Gas (kBtu)[4]	1,965,281
Total Energy (kBtu)	3,281,507

Energy Intensity[5]	
Site (kBtu/ft²/yr)	94
Source (kBtu/ft²/yr)	186

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	305

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	65
National Average Source EUI	136
% Difference from National Average Source EUI	37%
Building Type	Recreation

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, Licensed Professional facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

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

Direct Install 2010 Program*

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

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program*

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

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

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

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

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

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

Other Federal and State Sponsored Programs

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

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

APPENDIX G: ENERGY CONSERVATION MEASURES

	ECM #	ECM description	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
0-5 Year Payback	1	**Install five (5) lighting day light sensors**	125	975	8,750	1.8	0	0.9	0	1,460	15	21,918	0.7	2148	143	150	15,716	15,666
	2	**Install one (1) new CFL fixture**	0	9	28	0	0	0.0	4	9	5	45	1.0	401	80	97	32	49
	3	**Install two (2) VendingMiser™ devices on refrigerated vending machines**	0	398	728	0.2	0	0.1	0	122	5	608	2.5	104	21	30	256	1,303
	4	**Install one (1) SnackMiser™ device on a vending machine**	0	99	175	0	0	0.0	0	29	5	146	3.4	48	10	15	34	313
	5	**Install twenty-eight (28) lighting occupancy sensors**	560	5,600	9,208	1.9	0	0.9	0	1537	15	23,067	3.6	312	21	27	12,495	16,487
	6	**Install eight (8) Demand-Controlled Ventilation Systems**	0	9,600	13,314	2.8	106	1.6	0	2339	12	28,077	4.1	192	16	22	13,414	25,007

Payback category	ECM #	ECM description	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
	7	**Building Management System and VFD Controls Upgrade**	0	30,000	30,858	6.4	983	5.9	0	6,232	10	62,316	4.8	108	11	16	22,619	66,087
5-10 Year Payback	8	**Install one (1) 15 HP NEMA premium efficiency motor**	45	1,635	1,652	0.3	0	0.2	0	276	12	3,311	5.9	102	9	13	1,079	2,958
5-10 Year Payback	9	**Install six (6) new bi-level lighting fixtures**	150	850	825	0.2	0	0.1	0	138	15	2,066	6.2	143	10	14	771	1,477
5-10 Year Payback	10	**Install two (7.5) 15 HP NEMA premium efficiency motors**	90	1,814	1,752	0.4	0	0.2	0	293	12	3,511	6.2	94	8	12	1,064	3,137
5-10 Year Payback	12	**Install one (1) 5 HP NEMA premium efficiency motor**	54	711	572	0.1	0	0.1	0	96	12	1,146	7.4	61	5	8	229	711
5-10 Year Payback	13	**Install two (2) 3 HP NEMA premium efficiency motors**	108	1,121	878	0.2	0	0.1	0	147	12	1,760	7.6	57	5	8	321	1,572
5-10 Year Payback	14	**Replace one (1) gas fired domestic hot water heater with two (2) ENERGY STAR® qualified gas fired tankless domestic hot**	400	3,000	0	0.0	360	1.0	0	395	15	5,924	7.6	97	6	10	1,647	3,968

		water heaters																
	15	**Replace one (1) hot water space heating boiler with an ENERGY STAR® gas fired condensing model**	1,681	16,816	0	0	1,753	5.0	0	1,923	20	38,461	8.7	129	6	10	11,272	19,323
Renewable ECMs	11	**Install 30 kW Solar Photovoltaic system**	22,500	187,500	35,400	30	0	3.5	0	26,910	25	672,74 8	7.0	259	10	12	155,293	63,384

APPENDIX H: VendingMiser™ and SnackMiser™ Energy Savings

EnergyMisers

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

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.

Note: To calculate for CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)	0.167
Facility Occupied Hours per Week	84
Number of Cold Drink Vending Machines	2
Number of Non-refrigerated Snack Machines	1
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	40
VendingMiser® Sale Price (for cold drink machines)	$199.00
SnackMiser™ Sale Price (for snack machines)	$99.00

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	1747	1019	728	42%
Cost of Operation	$291.78	$170.21	$121.58	42%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	349	175	175	50%
Cost of Operation	$58.36	$29.18	$29.18	50%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	2097	1194	903	43%
Cost of Operation	$350.14	$199.38	$150.75	43%

Total Project Cost	Break Even (Months)
$497	39.56

Estimated Five Year Savings on ALL Machines = $753.77

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

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

Disclaimer

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

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