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August 20, 2010

Local Government Energy Program
Energy Audit Report-FINAL

The Township of Millburn

Town Hall building
375 Millburn Ave
Millburn, NJ 07041

Project Number: LGEA58

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EXECUTIVE SUMMARY

The Town Hall is a two-story building with basement comprising a total conditioned floor area of 13,358 square feet. The original structure was built in 1912, with renovations or additions in the early 1980's. The following chart provides an overview of current energy usage in the building based on the analysis period of February 2009 through January 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage, gal/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	215,760	8,901	N/A	47,155	118	1,626
Proposed	143,184	7,670	N/A	29,818	90	1,254
Savings	72,576	1,231	N/A	17,337	28	372
% Savings	33.6	13.8	N/A	36.8	23.6	22.9

There may be energy procurement opportunities for the Town Hall to reduce annual utility costs, which are $994 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Town Hall in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This public assembly facility is comprised of "Office" space type. The building performance rating is 23, compared to an ENERGY STAR® building's minimum certification eligibility score of 75. The site energy use intensity is 118 kBtu/ft^2/yr when compared to the national average site energy use intensity of 88 kBtu/ft^2/yr. The resulting score is 23, which is worse than the average comparable building by 50%.

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	10,942	3.0	32,981	89,711
5-10 Year	4,389	9.2	40,356	42,821
Total	15,331	4.8	73,337	132,532

(Please note that first year savings in the table above include both utility costs and maintenance costs savings).

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 7 cars from the roads each year or avoiding the need of 218 trees to absorb the annual CO_2 generated.

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

Further Recommendations:

SWA recommends that the Township of Millburn further explore the following list for the Town Hall building:

- Capital Improvements
  - Resolve comfort complaints from occupants by installing new split units and furnaces
  - Replace exhaust fans
  - Replace boiler system
  - Replace single pane wood framed windows with double pane, low-e type vinyl framed windows (similar to newer windows in building)
  - Replace uninsulated wood and metal doors with insulated and weather-stripped RFP door types
  - Verify asbestos-like substance in basement for abatement
- Operations and Maintenance
  - Replace 2.2gpm aerators on all faucets with 0.5gpm aerators
  - Replace missing fiberglass batts in attic ceiling joist bays and install insulation throughout attic space evenly and consistently
  - Install insulated and weather-stripped dome cover over drop down stairs to attic
  - Use ENERGY STAR® labeled appliances
  - Provide weather stripping / air sealing
  - Investigate the roof valley above the left side of the main entrance for leaks, deteriorating roof finishes and damaged or compromised roof and valley flashing.
  - Perform preventative exterior wall maintenance
  - Remove or trim overgrown vegetation in close proximity or touching the building
  - Refinish or replace deteriorated exterior woodwork, moldings and trim
  - Maintain downspouts
  - Use smart power electric strips
  - Create an energy educational program

Financial Incentives and Other Program Opportunities

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Township of Millburn. Based on the requirements of the LGEA program, Township of Millburn 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 $652. The table below summarizes the recommended ECMs that Township of Millburn can undertake for achieving this purpose. It is important to note that the required 25% expenditure is per building and after the other implementation incentive amounts.

Table 3: Next Steps for the BUILDING

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Install new LED exit sign fixtures to be installed with incentives	NJ Smart Start

There are various incentive programs that the Township of Millburn could apply for that could help lower the cost of installing the ECMs. For the Fire Department Headquarters, and contingent upon available funding, SWA recommends the following incentive programs:

Smart Start: Majority of energy saving equipment and design measures have moderate incentives under this program; however, this is the best choice among the alternatives available.

Renewable Energy Incentive Program: Receive up to $0.8/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by renewable energy, receive a credit between $475 and $600.

Please refer to Appendix F for further details.

INTRODUCTION

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

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

SWA performed an energy audit and assessment for the Town Hall building at 375 Millburn Ave, Millburn, NJ 07041. The process of the audit included facility visits on March 31st, 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 Millburn to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Town Hall.

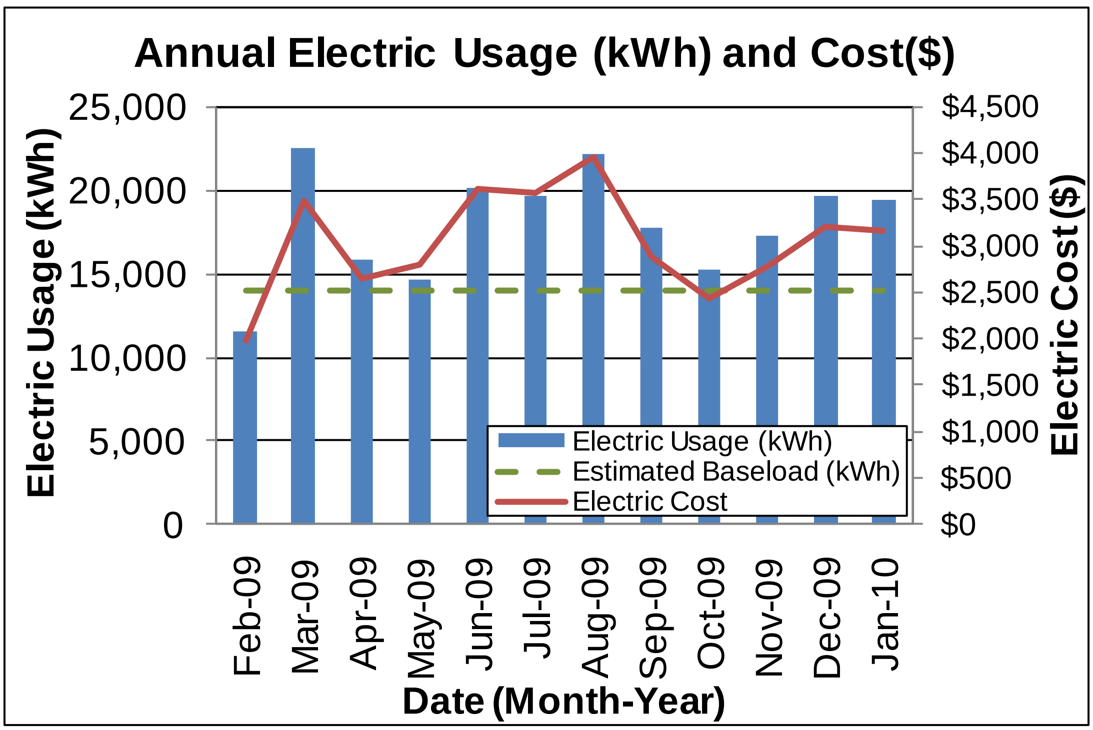
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

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

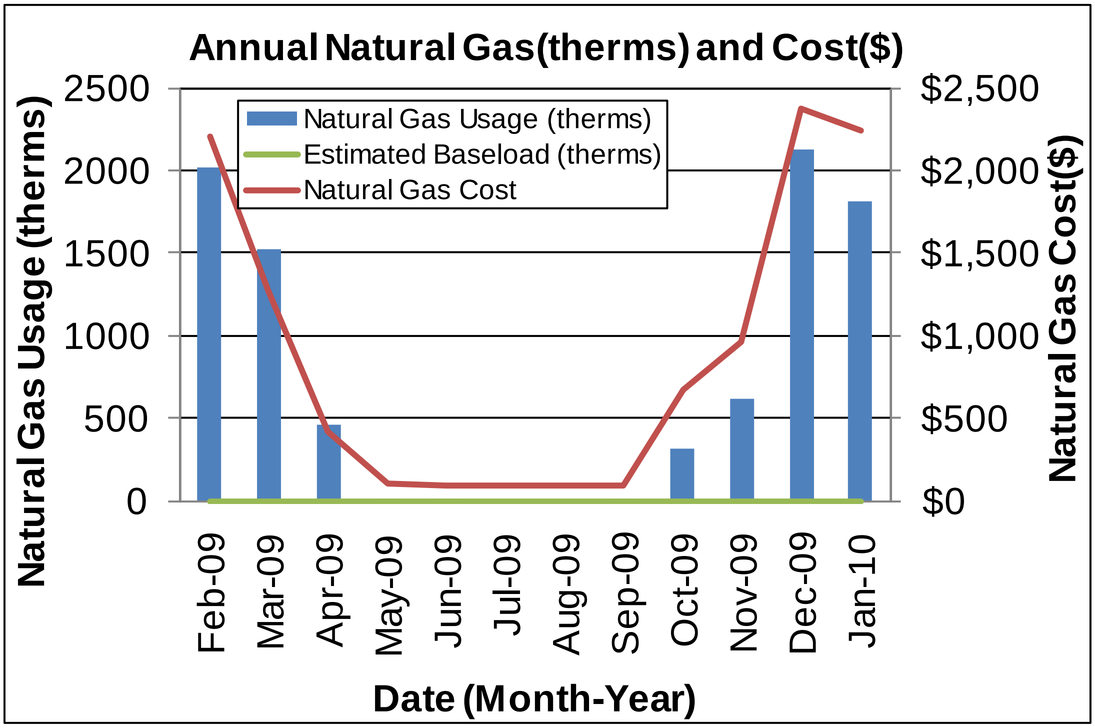
Electricity - The Town Hall building is currently served by one electric meter. The Township currently buys electricity for the Town Hall building from JCP&L at **an average aggregated rate of $0.169/kWh**. The Township purchased **approximately 215,760 kWh, or $36,522 worth of electricity,** for the Town Hall building in the previous year. The average monthly demand was 58.0 kW and the annual peak demand was 71.8 kW.

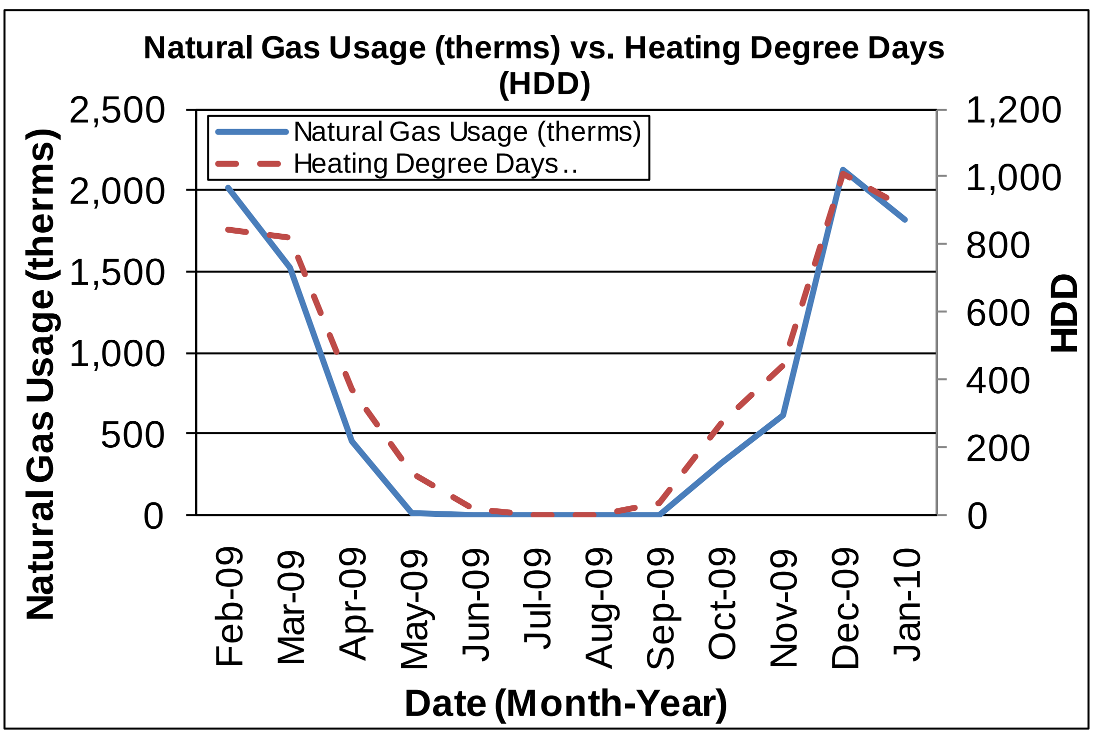
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base-load or minimum electric usage required to operate the Town Hall building.



Natural gas - The Town Hall building is currently served by one meter for natural gas. The Township currently buys natural gas from PSE&G for the Town Hall building at **an average aggregated rate of $1.195/therm**. The Township purchased **approximately 8,901 therms, or $10,633 worth of natural gas,** in the previous year for the Town Hall building.

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

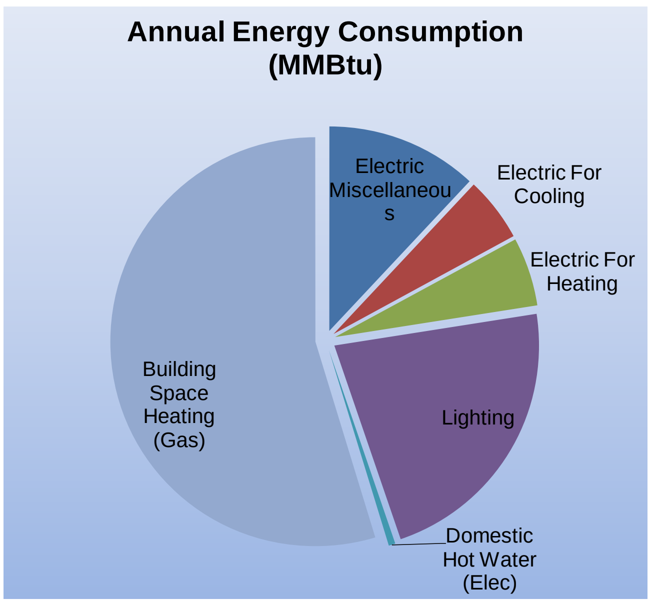


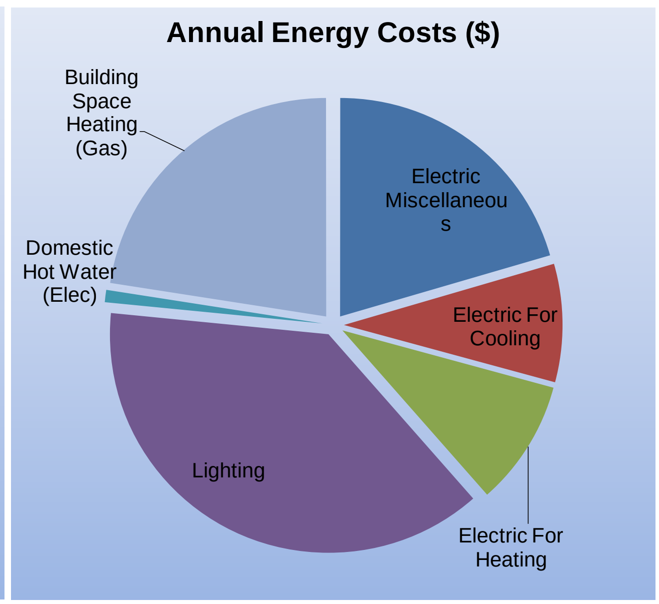


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the Town Hall building based on utility bills for the 12 month period. Note: electrical cost at $50/MMBtu of energy is 4.1 times as expensive as natural gas at $12/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	195	12%	$9,660	20%	50
Electric For Cooling	83	5%	$4,117	9%	50
Electric For Heating	88	5%	$4,388	9%	50
Lighting	362	22%	$17,934	38%	50
Domestic Hot Water (Elec)	9	1%	$424	1%	50
Building Space Heating	890	55%	$10,633	23%	12
Totals	1,626	100%	$47,155	100%	
Total Electric Usage	736	45%	$36,522	77%	50
Total Gas Usage	890	55%	$10,633	23%	12
Totals	1,626	100%	$47,155	100%	

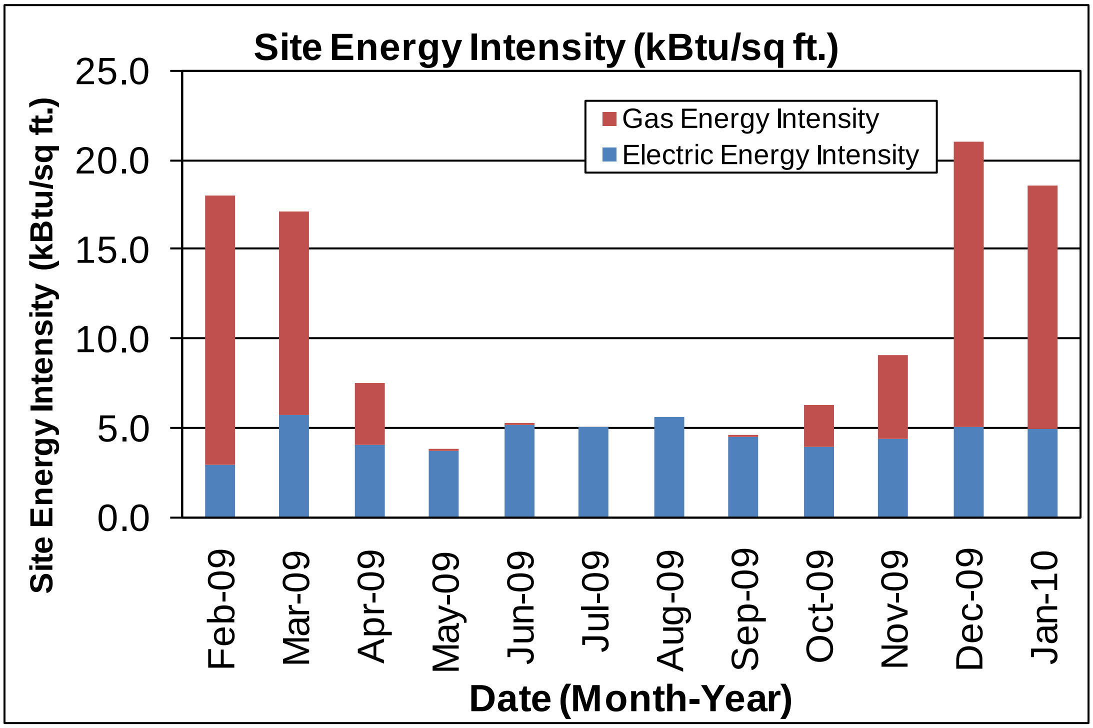




Energy benchmarking

SWA has entered energy information about the BUILDING in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This municipal office building is categorized as an "Office" space type. The building received an energy performance rating of 23. The rating is based on total source energy. A minimum score of 75 is eligible to qualify for ENERGY STAR® certification.

The Site Energy Use Intensity is 118 kBtu/ft^2-yr compared to the national average of an "Office" building consuming 88 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.



Per the LGEA program requirements, SWA has assisted the Township to create an *ENERGY STAR® Portfolio Manager* account and share the Town Hall building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Municipality (user name of "MillburnTownship" with a password of "MILLBURNTOWNSHIP") and TRC Energy Services (user name of "TRC-LGEA")

Tariff analysis

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

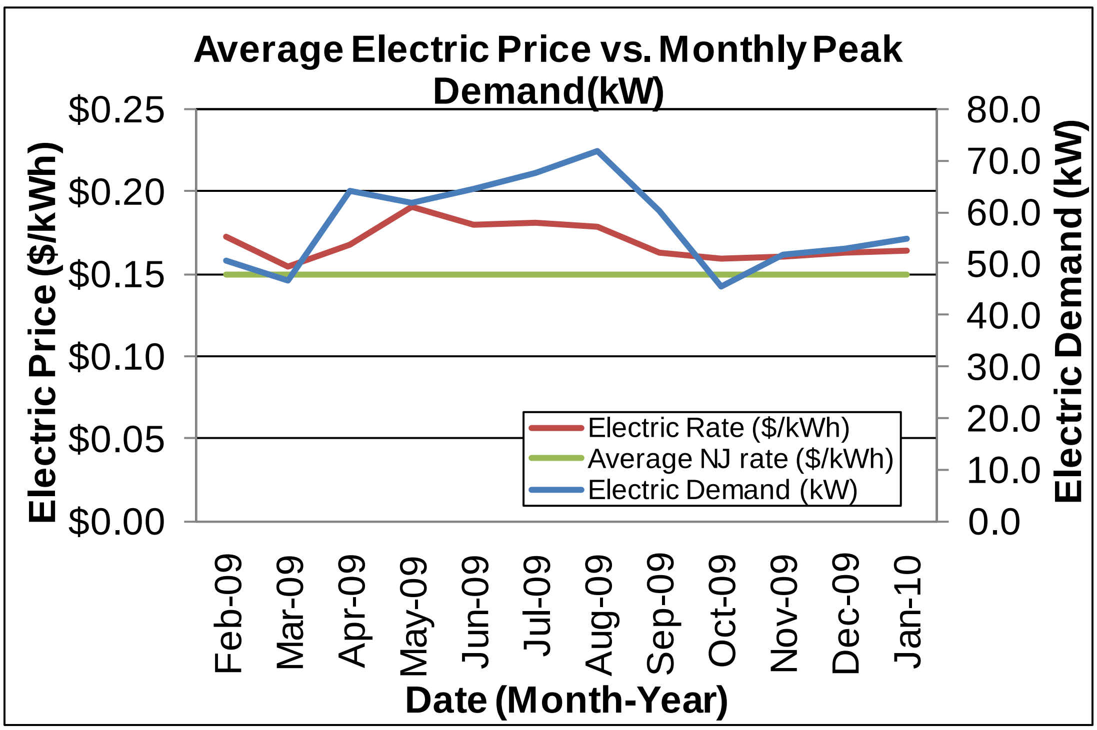
Tariff analysis is performed to determine if the rate that a municipality has contracted to pay each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by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

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

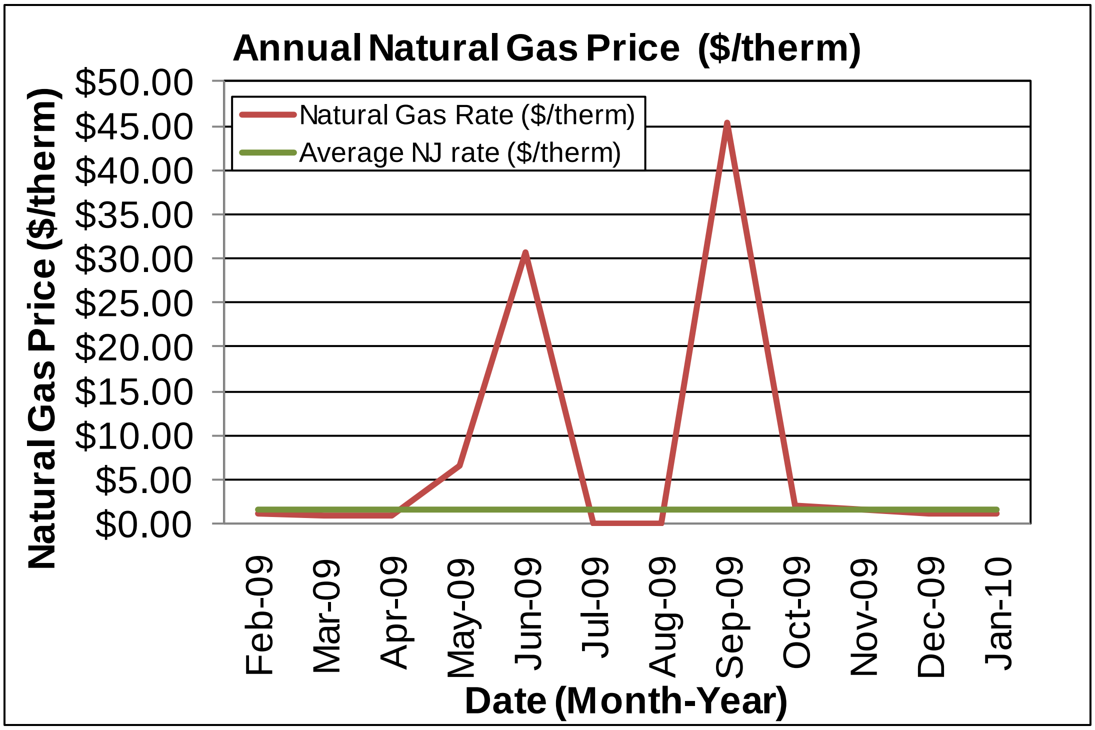
Energy Procurement strategies

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

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while the Township pays a rate of $0.169/kWh for the Town Hall building. The Town Hall building annual electric utility costs are $4,158 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 19% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while the Township pays a competitive rate of $1.195/therm for the Town Hall building. Natural gas bill analysis shows fluctuations up to 98% 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. Summer rates are greatly affected by low gas consumption and fixed meter charges.

SWA recommends that the Township 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 Town Hall building. Appendix C contains a complete list of third-party energy suppliers for the Millburn service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

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

Based on visits from SWA on March 31, 2010, the following data was collected and analyzed.

Building Characteristics

The two-story (including a partial basement), 13,358 square foot Town Hall Building was originally constructed in 1912 with additions/alterations completed in the early 1980’s. The Town Hall is a government bldg housing multiple government employees in engineering, building, tax and business departments.

Rear of building

Front of Town Hall building

Side entrance

Building occupancy profiles

The building occupancy is approximately 35 employees from 8:30am to 4:30pm, Monday through Friday.

Building envelope

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

Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer with some exposed cast-in-place concrete (in proximity of the windows) over 3-1/2" wood stud framing with a presumed

1-2” of fiberglass batt insulation. The interior is mostly painted gypsum wallboard and/or lath and plaster.

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

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

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

Overgrown ground vegetation growing on exterior wall surfaces

Interior wall damage showing moisture penetrating from exterior wall issue or roof run off compromising wall cavity

Damaged plaster wall section in basement

Roof

The building’s roof is predominantly a steep-pitch gable type over a wood structure, with a slate shingle finish. It is in good condition with no signs of obvious damage. According to maintenance personnel, shingle replacements and maintenance are done on a regular basis. Approximately two inches of fiberglass batt attic/ceiling insulation was observed beneath the attic flooring, although some areas are missing batts (which may have an effect on comfort issues in spaces on the second floor). A small roof section is a flat roof with dark colored EPDM single membrane finish.

Bays between ceiling joists void of insulation

Duct chases permitting cold/hot attic air into conditioned building

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good, age-appropriate condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues mostly detected on sloped roof areas.


Typical slate shingle roof image

The following specific roof problem spots were identified:


Signs of standing water/pooling


Chipped paint and potential wood rot due to water runoff


Damaged ceiling tile from plumbing leak or roof run off

Base

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

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

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

Windows

The building contains two different types of windows:

1. Half of the windows are double-hung type windows with a wood frame, single pane glazing and storms. Most of the windows are located on the front of the building and are original/have never been replaced.
2. The rest of the windows are double-hung type windows, double glazed with vinyl framing and were recently replaced. These windows are in good condition.

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.

The following specific window problem spots were identified:

Single-glazed aged window with damaged frame

Exterior doors

The building contains several different types of exterior doors.

1. There are many wood type exterior doors located throughout the building and are original and have never been replaced.
2. The side entrance has a glass door in good condition, in need of additional weather-stripping.
3. There is one older metal door leading to the flat attic area, in need of replacement.

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 poor/ age appropriate condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Un-insulated door with worn weather-stripping

Un-insulated wood door

Damaged door leading to flat roof section

Building air tightness

Overall the field auditors found the building not adequately air-tight with numerous 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. Asbestos-like substance was found on piping in the basement of the

building. This substance should be tested and removed before the building air tightness is improved.

Asbestos-like substance found on piping in basement

Mechanical Systems

Heating Ventilation Air Conditioning

HVAC for this building is provided by condensing gas fired furnaces and a DX gas fired roof top package unit. The building is zoned into external and internal areas. Perimeter areas of the building are provided heating and cooling by means of condensing gas fired furnaces, and internal area of the building is provided HVAC by the roof top unit.

Energy use intensity of this building, 118kBtu/sqft, compared to other office buildings energy use intensity of 88kBtu/sqft is quite high. SWA attributes this to building heating by way of gas use. All gas consuming units are relatively new and highly efficient. The cause for high heating may be consumption of greater than required fresh air quantity, or operating units during night without setbacks. SWA recommends the city to carry out retro-commissioning to address any or both these problems at the same time.

There is a Weil McLain steam boiler in the basement which is not in use anymore. All associated piping, pumps, and steam radiators have been abandoned in situ in the year 2000. As a result, there are no heating baseboards or radiators to counter the cold draft under windows. SWA noted a few scattered electric plug-in heaters to counter the cold draft, which is especially problematic under single pane windows.

Generally, there were a few comfort complaints from occupants. SWA determined the basic cause of complaint to be insufficient zoning, and multiple spaces in a zone being served by only one thermostat. Unfortunately, there is no quick fix for these problems, which will require a capital outlay to redesign and install new HVAC units.

Equipment

The Town Hall building is heated and/or cooled by one rooftop package unit, four split cooling gas fired furnaces with outdoor condensers, and some other simple split air conditioning units. A comprehensive Equipment List can be found in Appendix A.

The rooftop unit contains a natural gas burner for heating and a direct expansion (DX) system for cooling, made up of an evaporator, condenser and refrigerant loop. The unit was manufactured by Trane and installed in 2000. It consists of a down flow enthalpy controlled economizer and a high efficiency supply fan motor. The unit is in good condition and still has about five years of useful life remaining. This unit provides heating, cooling, and ventilation for interior areas of the building.

Rooftop packaged unit providing heating and cooling to building

The furnace units also contain a natural gas burner for heating and evaporator section for cooling, however the condensing are separate units located outside/on the roof. The heating efficiency of these units is expected to go as high as 95% as they are condensing furnaces equipped with PVC flue pipes to handle low temperature exhaust. The indoor units are estimated to have been installed in 2005 and are in excellent condition. The usual life of these units is about 15 years. Outdoor condensing units are of varying ages. Some units installed in 1998 are nearing the end of lives and are not highly energy efficient as they are only 10 SEER rated. SWA recommends replacing these with newer units having SEER rating of 15 and above.

There are five exhaust fans which serve the bathrooms and general exhaust as noted in Appendix A. Not all fan nameplate data could be seen at the site as they were inaccessible. Generally, most fans have outlived their useful service lives and must be replaced as part of capital improvement.

There is an old Weil McLain steam boiler in the basement, which was originally designed as a bomb shelter. The boiler is rated for 2390MBH input using natural gas as fuel. The boiler is not in use and has been left abandoned. This boiler and associated piping and pumps could be replaced for better comfort control to avoid cold drafts as part of capital improvement.

Controls

The heating and cooling equipment is controlled by a mix of manual and programmable thermostats of various manufacturers. Some thermostats did not seem to be programmed correctly and may not work as intended. It is possible that night setback schedules are not maintained in winter, and that comfort conditions may be maintained even in unoccupied modes. Further, there are many thermostats and sensors that are not in use, but were not removed when the boiler system was disabled. SWA recommends the city to hire a controls professional to take out all existing thermostats, and install new programmable thermostats with brand new time of day schedules as part of energy conservation measure.

Domestic Hot Water

The domestic hot water (DHW) for the Town Hall building is provided by an electric heated Rheem 82V52-2, 50 gal storage tank, and 3 electric coil heating elements. The heater was installed in 2005 and is in good condition; however, SWA recommends replacing this with a new gas fired direct vent heater as an energy conservation measure.

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.

Interior Lighting - The Town Hall building currently contains mostly T12 fixtures and ceiling mounted fixtures with incandescent bulbs. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Chandelier with incandescent bulbs
On second floor in hallway

Exit Lights - Exit signs were found to contain fluorescent and incandescent bulbs.

Exit sign found in court room

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide and incandescent fixtures. Exterior lighting is controlled by 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.

Elevators

The Town Hall building has one hydraulic elevator manufactured by Dover which was installed in 1986, and has a 20 HP motor. This is sparingly used and in good condition.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Town Hall building. However, space heaters and dehumidifiers can impact the electrical load and should be used sparingly, on an as needed basis.

Space heaters found in various office areas; One of two dehumidifiers in basement

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

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

Existing systems

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

Evaluated Systems

Solar Photovoltaic

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

Based on utility analysis and a study of roof conditions, the Town Hall building is a good candidate for a 5.2kW Solar Panel installation. See ECM# 12 for details.

Solar Thermal Collectors

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

Geothermal

The Town Hall building is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have about 50% remaining useful life.

Combined Heat and Power

The Town Hall building is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electric base-load to accommodate the electricity generated, as well as a means for using waste heat generated.

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	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	annual return on investment, %	CO_2 reduced, lbs/yr
1	39 New CFL fixtures to be installed	1,562	7,331	1.5	0	1.9	5	6,370	1.2	64	13,126
2	12 New LED exit sign fixtures to be installed with incentives	1,026	9,145	1.9	0	2.3	15	23,183	0.7	144	16,374
3	8 New pulse start metal halide fixtures to be installed with incentives	3,195	1,804	0.4	0	0.5	15	10,768	4.5	29	3,230
4	38 New occupancy sensors to be installed with incentives	7,600	13,204	2.8	0	3.4	15	33,472	3.4	23	23,642
5	224 New T8 fixtures to be installed with incentives	32,813	17,832	3.7	0	4.6	15	50,649	9.7	5	31,928
6	6 New motion sensors to be installed with incentives	1,200	1,068	0.2	0	0.3	15	2,707	6.6	8	1,912
7	6 New bi-level fixtures to be installed with incentives	885	592	0.1	0	0.2	15	1,501	8.8	5	1,060
8	Retro-commissioning of HVAC systems	16,698	8,012	2.1	890	8.7	12	50,853	3.9	28	24,158
9	Replace condensing units	3,358	2,014	0.5	0	0.5	12	4,084	9.9	2	3,606
10	Install Programmable Thermostat	2,900	2,388	0.6	445	3.9	12	11,225	3.1	24	9,182
11	Replace (1) electric DHW with a Natural gas Direct Vent model	2,100	3,050	0.8	-104	0	12	4,694	5.4	10	4,315

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%

Notes:

1. A 0.0 electrical demand reduction/month indicates that it is very low/negligible
2. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential interaction between retrofits between some of the listed ECMs (i.e. lighting change influence on heating/cooling.

ECM#1, 2, 3, 4, 5, 6, & 7: *Building Lighting Upgrades*

On the days of the site visits, SWA completed a lighting inventory of the Town Hall building (see Appendix B). The existing lighting consists of mostly T12 fluorescent fixtures with magnetic ballasts. SWA recommends installing occupancy sensors in bathrooms, closets, offices and areas where 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. SWA recommends replacing incandescent and halogen lamps with CFL lamps. Also, SWA recommends replacing the Metal Halide lamps with Pulse Start Metal Halide lamps. Pulse Start Metal Halide (MH) lamps produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Millburn may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $56,471
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	39 New CFL fixtures to be installed	1,562	0	1,562	7,331	1.5	0	1.9	35	1,274	5	6,370	1.2	319	64	77	4,239	13,126
2	12 New LED exit sign fixtures to be installed with incentives	1,266	240	1,026	9,145	1.9	0	2.3	0	1,546	15	23,183	0.7	2,160	144	151	17,160	16,374
3	8 New pulse start metal halide fixtures to be installed with incentives	3,395	200	3,195	1,804	0.4	0	0.5	413	718	15	10,768	4.5	431	29	20	5,252	3,230
4	38 New occupancy sensors to be installed with incentives	8,360	760	7,600	13,204	2.8	0	3.4	0	2,231	15	33,472	3.4	340	23	28	18,658	23,642
5	224 New T8 fixtures to be installed with incentives	39,533	6,720	32,813	17,832	3.7	0	4.6	363	3,377	15	50,649	9.7	71	5	3	6,920	31,928
6	6 New motion sensors to be installed with incentives	1,320	120	1,200	1,068	0.2	0	0.3	0	180	15	2,707	6.6	126	8	11	924	1,912
7	6 New bi-level fixtures to be installed with incentives	1,035	150	885	592	0.1	0	0.2	0	100	15	1,501	8.8	70	5	5	292	1,060
	TOTAL	56,471	8,190	48,281	50,976	11	0	13	811	9,426		128,650	5.12					91,273

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

Rebates/financial incentives:

- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $200.*
- *NJ Clean Energy – Occupancy and motion sensors ($20 per control) - Maximum incentive amount is $880.*
- *NJ Clean Energy – LED exit sign fixtures ($20 per fixture) - Maximum incentive amount is $240.*
- *NJ Clean Energy – Bi-level fixtures ($25 per fixture) - Maximum incentive amount is $150.*
- *NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps) Maximum incentive amount is $6,720.*

Please see Appendix F for more information on Incentive Programs.

ECM#8: *Retro-Commissioning*

Description:

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

Since the systems at the Town Hall have undergone some renovations in recent years, and the building continues to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures and (setback) schedules should also be reviewed to identify opportunities for optimizing system performance, besides air balancing and dampers' proper operation. In particular, for retro-commissioning to be highly effective, it is best to conduct a ventilation requirement study as per ASHRAE 62.1 standard to allow proper settings for the ventilation dampers.

Installation cost:

Estimated installed cost: $16,698 (includes $13,350 of labor)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8	Retro-commissioning of HVAC systems	16,698	0	16,698	8,012	2.1	890	8.7	1,820	4,238	12	50,853	3.9	335	28	23	24,986	24,158

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling for the Town Hall. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings for both, electric and natural gas. Estimated costs for retro-commissioning range from

$0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total square footage of 13,358. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates/financial incentives:

There are not any current incentives for this measure at this time.

ECM#9: Replace Condensing Units

SWA recommends replacing (2) existing condensing units with ENERGY STAR® rated condensing units with higher operating efficiency. A split-system central air conditioner consists of an outdoor metal cabinet called the condensing unit which contains the condenser coil and compressor, and an indoor cabinet contains the evaporator coil and supply air fan. Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER - Btu/Watt-hr), which indicates the relative amount of energy needed to provide a specific cooling output. The two 1998 condensing units have SEER ratings of 10; minimum SEER allowed today is 13. ENERGY STAR® label central air conditioners with SEER ratings of 13 or greater, and up to 16 SEER condensing units are now available. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov. SWA recommends 15 SEER units.

Installation cost:

Estimated installed cost: $3,680 (includes $480 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9	Replace condensing units	3,680	322	3,358	2,014	0.5	0	0.5	0	340	12	4,084	9.9	22	2	3	-10	3,606

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the annual electric savings calculated from EnergyStar online calculator as 2,014 kWh.

Rebates/financial incentives:

NJ Clean Energy – Unitary HVAC/Split Systems, 14 SEER minimum, $92/ton for units less than or equal to 5.4tons capacity; maximum incentive available is $322.

ECM#10: Install Programmable Thermostats

SWA noted that there are four heating/cooling furnaces and one roof top package unit serving the whole building in 5 main zones. Each zone is equipped with a programmable thermostat, but each one is of a different make and did not appear to be programmed for allowing non-occupied mode settings and set backs. SWA recommends that all 5 thermostats are replaced and reprogrammed, with occupied mode settings and non-occupied mode settings – for example, latter may be set to 55 deg F when the outside temperature is below 40 deg F. Besides these thermostats, there are multiple other sensors/thermostats that have been left installed in various spaces when boiler system was disabled. SWA recommends removing all unnecessary thermostats to maintain transparency and clarity.

Installation cost:

Estimated installed cost: $2,900 (includes $2,400 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
10	Install Programmable Thermostat	2,900	0	2,900	2,388	0.6	445	3.9	0	935	12	11,225	3.1	287	24	31	6,301	9,182

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated 1/2% heating and cooling electric and gas savings conservatively.

Rebates/financial incentives:

There are not any current incentives for this measure at this time.

ECM#11: Replace Electric Domestic Water Heater with Direct Vent Gas Fired Unit

Description:

There is one (1) electric floor-mounted domestic water heater located in the Boiler Room that produces the domestic hot water for toilets and the kitchen sink. The water heater installed in 2005 utilizes a 50 gallon storage tank and is in fair condition. Based on the age and expected service life of 10-15 years, Township of Millburn may wish to replace this heater with a more efficient gas fired heater and tank as part of a capital improvement plan. The existing boiler flue could be utilized for the new DHW flue exhaust, and gas is available nearby too.

Installation cost:

Estimated installed cost: $2,100 (includes $630 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
11	Replace (1) electric DHW with a Natural gas Direct	2,150	50	2,100	3,050	0.8	-104	0	0	391	12	4,694	5.4	124	10	15	1,748	4,315

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the annual electric usage for the domestic water heating system approximately 3,050 kWh. The new high efficiency gas fired water heater would operate with an efficiency of approximately 95%.

Rebates/financial incentives:

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

ECM#12: *Install 5.2 kW PV System*

Description:

Currently the Town Hall does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month's period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. It is recommended at this time that the Town Hall further review installing a 5.2 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Town Hall may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SREC's at $600/MWh or best market offer.

The building has flat and sloping roof with limited locations for portions of a 5.2 kW PV installation on the building roof. A commercial crystalline 123 watt panel has 10.7 square feet of surface area (11.5 watts per square foot). A 5.2 kW system needs approximately 42 panels which would take up 500 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $31,200 (including $12,480 total labor cost)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
12	Install 5.2 kW Solar Photovoltaic system	Similar Projects	36,400	4,160	32,240	6,136	5	0	1.6	0	4,637	25	79,925	7.0	148	592	10	$27,783	10,987

Cash Flow Year 0	-$32,240								
Cash Flow Year 1	$4,637	Cash Flow Year 6	$4,637	Cash Flow Year 11	$4,637	Cash Flow Year 16	$1,037	Cash Flow Year 21	$1,037
Cash Flow Year 2	$4,637	Cash Flow Year 7	$4,637	Cash Flow Year 12	$4,637	Cash Flow Year 17	$1,037	Cash Flow Year 22	$1,037
Cash Flow Year 3	$4,637	Cash Flow Year 8	$4,637	Cash Flow Year 13	$4,637	Cash Flow Year 18	$1,037	Cash Flow Year 23	$1,037
Cash Flow Year 4	$4,637	Cash Flow Year 9	$4,637	Cash Flow Year 14	$4,637	Cash Flow Year 19	$1,037	Cash Flow Year 24	$1,037
Cash Flow Year 5	$4,637	Cash Flow Year 10	$4,637	Cash Flow Year 15	$4,637	Cash Flow Year 20	$1,037	Cash Flow Year 25	$1,037

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 (123 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.80 / watt Solar PV application for systems 50 kW or less.

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 $3,600 has been incorporated in the above costs however it requires proof of performance, application approval and negotiations with the utility.

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 Town Hall building:

- Resolve comfort complaints from occupants – this entails redesign of HVAC systems and installing new furnaces of the type already installed serving other zones. Installing a new gas fired condensing furnace with split system cooling can cost between $15,000 and $20,000 each. SWA estimated that two or three such systems may be required to overcome the current comfort complaints. SWA recommends the Township to hire a professional engineer to properly design and select the new system.

- Replace exhaust fans – there are five exhaust fans in the building which are operating beyond the service lives and should be replaced. As energy savings would be minimal, SWA recommends replacing these fans as part of capital improvement, at an estimated cost of $2,450.

- Replace boiler system – the current boiler was disabled along with associated pipes and steam radiators leading to comfort issues arising from cold drafts especially under the single pane windows. SWA recommends installing a new condensing boiler, estimated at 1000MBH capacity to replace the existing one. The design should again be reviewed by a professional engineer for correct sizing and design. Estimated cost of replacement is around $150,000.

- Replace single pane wood framed windows with double pane, low e type vinyl framed windows (similar to newer windows in building)

- Replace un-insulated wood and metal doors with insulated and weather-stripped RFP door types

- Verify asbestos-like substance in basement for abatement

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.

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily replace 2.2gpm faucet aerators with 0.5gpm 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.

- Consistently and evenly insulate the ceiling joist bays with fiberglass batt insulation and seal all ceiling penetrations. All damaged tiles should be replaced to prevent indoor air quality issues.

- Install insulated and weather-stripped dome cover over drop down stairs to attic. The cover can be easily constructed with foil faced polyisocyanurate rigid insulation, creating a box that fits tightly over the attic drop down stairs. The plywood hatch should also be weather-stripped to prevent the loss of expensive conditioned air.

- 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 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.

- SWA recommends investigating the roof for leaks, deteriorating roof finishes and damaged or compromised roof and valley flashing. A faulty roof flashing detail seems to cause water penetrating into the wall cavity. Visible from the exterior as flaking and blistering paint and stucco, the water trickles down inside the wall cavity until it reached the basement slab, its origin being misinterpreted as foundation wall leakage or ground water seepage.

- Preventative exterior wall maintenance - SWA recommends as part of the maintenance program to install proper flashing, correct masonry efflorescence and seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.SWA recommends having any deteriorated or missing stone and masonry cavities filled or re-pointed with mortar or appropriate caulk to minimize and prevent water and moisture infiltration into the envelope assemblies.

- Remove or trim overgrown vegetation in close proximity or touching the building to allow adequate air and sun exposure to all parts of the exterior envelope.

- Refinish or replace deteriorated exterior woodwork, moldings and trim to minimize and prevent water and moisture infiltration into wall or roof assemblies.

- 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.

- 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 their energy use. The US 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/

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
HVAC	Condensing gas fired furnace, input 120MBH, ADP cooling coil, model TE50460, S/N S6002B56340, 4 tons	Attic	Trane, Model TUD120C960K1, S/N 2362HCW1G	Elec./Gas	1st floor, west side	2003	65%
Cooling	Condensing unit, 4 tons, R22, 208/1/60, MCA26, SEER12	Roof	Trane, Model 2TTR2048A1000AA, S/N 30531YH3F	Elec.	1st floor, west side	2003	53%
HVAC	Condensing gas fired furnace, input 60MBH, ADP cooling coil, model HA12436C, S/N 6097K28946, 2.5 tons	Attic	Trane, Model TUC060C936B4, S/N M505TS57G	Elec./Gas	1st floor, south east side	2003	65%
Cooling	Condensing unit, 2.5tons, R22, 208/1/60, MCA17, SEER10 est.	Roof	Trane, Model TTP030C100B0, S/N N0814GDCF	Elec.	1st floor, south east side	1998	20%
HVAC	Condensing gas fired furnace, input 40MBH, 1.5 tons	Attic	Trane, Model TUC040C924B6, S/N P5145MD7G	Elec./Gas	2nd floor, west side	2003	65%
Cooling	Condensing unit, 1.5tons, R22, 208/1/60, MCA11, SEER10 est.	Roof	Trane, Model TTB018C100A1, S/N N033P3WAF	Elec.	2nd floor, west side	1998	20%
HVAC	Condensing gas fired furnace, input 140MBH, ADP cooling coil, model TE50460C2, S/N 6002B56342, 4 tons	Attic	Trane, Model TUD140C960K2, S/N 245123S1G	Elec./Gas	1st and 2nd floor, North side	2003	65%
Cooling	Condensing unit, 4tons, R22, 208/1/60, MCA20, SEER12	Roof	Trane, Model 2TTA2048A3000AA, S/N 3074TRM3F	Elec.	1st and 2nd floor, North side	2003	53%
Ventilation	General exhaust fan, centrifugal, BF3594, est. 2500cfm, 1hp motor	Attic	Peerless Electric, Model 11A	Elec.	Whole building	2003	53%
HVAC	Roof top package unit, gas fired, 208-230/3/60, MCA 132, 400/324 MBH in/out, 81% efficiency, R22, 7.5hp fan motor, high efficiency, IEER 10.4	Roof	Trane, Model YCD300B3HAFB, S/N R12100516D	Elec.	Internal areas for whole building	2000	33%
Cooling	Indoor air handler, 115/1/60, 0.45A	Server room	Sanyo, Model KS1271, S/N 0304063	Elec.	Server room	2006	73%
Cooling	Condensing unit, 115/1/60, 10.9A, MCA20	Outside on grade	Sanyo, Model CL1271, S/N 59363	Elec.	Server room	2006	73%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Cooling	Fan coil unit complete with cooling coil, 1/3hp motor, 208/1/60, FLA3.1, est 3 tons cooling	Basement	International Comfort Products, Model NFCX3600A1, S/N L9829 12489	Elec./Gas	1st floor, west side	2003	53%
Cooling	Condensing unit, 4tons,R22, 208/1/60, MCA21.5, SEER10	Outside on grade	Unitary Product Group, Coleman, Model BRCS0361BD, S/N 980830565	Elec.	1st floor, west side	1998 est.	20%
Cooling	Condensing unit, 4tons,R22, 208/1/60, MCA15.6	Outside on grade	Unitary Product Group, York, Model HABA-F0248A, S/N EDFM134882	Elec.	1st floor	1998 est.	20%
DHW	50 Gallon domestic hot water heater; 4.5kW*3 = 13.5kW total, 208/1/60	Basement	Rheem, Model 82V52-2, S/N RH0405201335	Elec.	Whole building	2005	67%
Ventilation	Exhaust fan, wall mounted, mushroom type, 1/2hp est.	Outside on wall	Jenn Air, Model 91 CW	Elec.	Stairwell exhaust	1990 est.	0%
Ventilation	Exhaust fan, wall mounted, mushroom type, 1/4hp est.	Roof	Make, model N/A	Elec.	Courtroom, general exhaust	1998 est.	0%
Ventilation	Exhaust fan, wall mounted, mushroom type, 1/2hp est.	Roof	Make, model N/A	Elec.	Courtroom, general exhaust	1998 est.	0%
Ventilation	Exhaust fan, wall mounted, mushroom type, 1/4hp est.	Roof	Make, model N/A	Elec.	General exhaust	1998 est.	0%
Ventilation	Toilet exhaust fan, wall mounted, mushroom type, 1/2hp est.	Roof	Make, model N/A	Elec.	Toilet exhaust	1998 est.	0%

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	Hallway	Recessed Parabolic	E	4'T8 U-Shaped	3	2	32	Sw	9	261	5	207	486	C	Recessed Parabolic	4'T8 U-Shaped	E	MS	3	2	32	7	261	5	207	365	0	122	122
2	2	Hallway	Recessed Parabolic	M	4'T12	3	2	40	Sw	9	261	12	276	648	T8	Recessed Parabolic	4'T8	E	MS	3	2	32	7	261	5	207	365	162	122	284
3	2	Hallway	Exit Sign	S	Inc	1	2	60	N	24	365	0	120	1,051	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	1003	0	1003
4	2	Council Room	Recessed Parabolic	M	4'T12	25	4	40	Sw	6	261	12	4,300	6,734	T8	Recessed Parabolic	4'T8	E	OS	25	4	32	5	261	5	3325	3905	1527	1302	2829
5	2	Council Room	Exit Sign	S	Inc	2	2	60	N	24	365	0	240	2,102	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	2006	0	2006
6	2	Staircase	Recessed Parabolic	M	4'T12	2	2	40	Sw	9	261	12	184	432	T8	Recessed Parabolic	4'T8	E	BL	2	2	32	0	261	5	138	189	108	135	243
7	2	Office	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
8	2	Office	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
9	2	Storage Closet	Recessed Parabolic	M	4'T12	2	2	40	Sw	2	261	12	184	96	T8	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	261	5	138	72	24	0	24
10	2	Bathroom Women	Recessed Parabolic	M	4'T12	1	4	40	OS	9	261	12	172	404	T8	Recessed Parabolic	4'T8	E	OS	1	4	32	9	261	5	133	312	92	0	92
11	2	Office	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	7	261	5	266	469	183	156	339
12	2	Office	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
13	2	Office	Recessed Parabolic	M	4'T12	5	4	40	Sw	9	261	12	860	2,020	T8	Recessed Parabolic	4'T8	E	OS	5	4	32	7	261	5	665	1172	458	391	849
14	2	Bathroom Men	Recessed Parabolic	M	6'T12	1	2	55	OS	9	261	17	127	298	T8	Recessed Parabolic	6'T8	E	OS	1	2	48	9	261	6	102	240	59	0	59
15	2	Lunch Rm	Recessed Parabolic	M	4'T12	2	2	40	Sw	8	261	12	184	384	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	6	261	5	138	216	96	72	168
16	2	Lunch Rm	Recessed Parabolic	M	4'T12	2	4	40	Sw	8	261	12	344	718	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	6	261	5	266	417	163	139	302
17	2	Office	Recessed Parabolic	M	4'T12	3	4	40	Sw	9	261	12	516	1,212	T8	Recessed Parabolic	4'T8	E	OS	3	4	32	7	261	5	399	703	275	234	509
18	2	Office	Recessed Parabolic	M	4'T12	15	4	40	Sw	9	261	12	2,580	6,060	T8	Recessed Parabolic	4'T8	E	OS	15	4	32	7	261	5	1995	3515	1374	1172	2546
19	2	Office	Exit Sign	S	Fl.	1	1	60	N	24	365	0	60	526	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	477	0	477
20	2	Staircase	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	BL	2	4	32	0	261	5	266	366	183	259	443
21	2	Office	Recessed Parabolic	M	4'T12	6	4	40	Sw	9	261	12	1,032	2,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	7	261	5	798	1406	550	469	1018
22	2	Office	Recessed Parabolic	M	4'T12	1	2	40	Sw	9	261	12	92	216	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	5	69	122	54	41	95
23	2	Meeting Rm	Recessed Parabolic	M	4'T12	8	4	40	Sw	8	261	12	1,376	2,873	T8	Recessed Parabolic	4'T8	E	OS	8	4	32	6	261	5	1064	1666	651	555	1207
24	2	Storage Closet	Ceiling Mounted	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Mounted	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
25	2	Storage Closet	Ceiling Mounted	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Mounted	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
26	2	Office	Flood	S	Inc	8	1	90	Sw	9	261	0	720	1,691	CFL	Flood	CFL	S	OS	8	1	30	7	261	0	240	423	1128	141	1268
27	2	Storage Closet	Ceiling Mounted	S	Inc	1	1	60	Sw	2	261	0	60	31	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	2	261	0	20	10	21	0	21
28	2	Hallway	Chandelier	S	Inc	4	3	60	Sw	9	261	0	720	1,691	CFL	Chandelier	CFL	S	Sw	4	3	20	9	261	0	240	564	1128	0	1128
29	2	Staircase	Chandelier	S	Inc	1	6	60	Sw	9	261	0	360	846	CFL	Chandelier	CFL	S	Sw	1	6	20	9	261	0	120	282	564	0	564
30	1	Office	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	7	261	5	266	469	183	156	339
31	1	Hallway	Recessed Parabolic	M	4'T12	6	4	40	Sw	9	261	12	1,032	2,424	T8	Recessed Parabolic	4'T8	E	MS	6	4	32	7	261	5	798	1406	550	469	1018
32	1	Staircase	Recessed Parabolic	M	4'T12	1	2	40	OS	9	261	12	92	216	T8	Recessed Parabolic	4'T8	E	BL	1	2	32	0	261	5	69	94	54	68	122
33	1	Office	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	7	261	5	266	469	183	156	339
34	1	Office	Recessed Parabolic	M	4'T12	1	4	40	Sw	9	261	12	172	404	T8	Recessed Parabolic	4'T8	E	OS	1	4	32	7	261	5	133	234	92	78	170
35	1	Office	Recessed Parabolic	M	4'T12	6	4	40	Sw	9	261	12	1,032	2,424	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	7	261	5	798	1406	550	469	1018
36	1	Office	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	7	261	5	266	469	183	156	339
37	1	Office	Recessed Parabolic	M	4'T12	18	3	40	Sw	9	261	12	2,376	5,581	T8	Recessed Parabolic	4'T8	E	OS	18	3	32	7	261	5	1818	3203	1311	1068	2378
38	1	Kitchen	Recessed Parabolic	M	4'T12	1	3	40	Sw	9	261	12	132	310	T8	Recessed Parabolic	4'T8	E	OS	1	3	32	7	261	5	101	178	73	59	132
39	1	Copy Room	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	7	261	5	266	469	183	156	339
40	1	Office	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
41	1	Lobby	Exit Sign	S	Fl.	2	1	60	N	24	365	0	120	1,051	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	955	0	955
42	1	Hallway	Exit Sign	S	Fl.	1	1	60	N	24	365	0	60	526	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	477	0	477
43	1	Hallway	Recessed Parabolic	M	4'T12	2	3	40	Sw	9	261	12	264	620	T8	Recessed Parabolic	4'T8	E	MS	2	3	32	7	261	5	202	356	146	119	264
44	1	Hallway	Exit Sign	S	Fl.	2	2	60	N	24	365	0	240	2,102	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	2006	0	2006
45	1	Building Dept	Recessed Parabolic	M	4'T12	26	4	40	Sw	10	261	12	4,472	11,672	T8	Recessed Parabolic	4'T8	E	OS	26	4	32	8	261	5	3458	6769	2647	2256	4903
46	1	Building Dept	Exit Sign	S	Fl.	2	2	60	N	24	365	0	240	2,102	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	2006	0	2006
47	1	Building Dept	Flood	S	Inc	4	1	60	D	10	261	0	240	626	CFL	Flood	CFL	S	D	4	1	20	10	261	0	80	209	418	0	418
48	1	Storage Closet	Ceiling Mounted	S	Inc	1	2	60	Sw	2	261	0	120	63	CFL	Ceiling Mounted	CFL	S	Sw	1	2	20	2	261	0	40	21	42	0	42
49	1	Office	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
50	1	Building Dept	Recessed Parabolic	M	4'T12 U-Shaped	1	2	40	Sw	10	261	12	92	240	T8	Recessed Parabolic	4'T8 U-Shaped	E	OS	1	2	32	8	261	5	69	135	60	45	105
51	1	Building Dept	Exit Sign	S	Fl.	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	215	0	215
52	1	Building Dept	Recessed Parabolic	M	4'T12	4	4	40	Sw	10	261	12	688	1,796	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	8	261	5	532	1041	407	347	754
53	1	Server Room Unoccupied	Recessed Parabolic	M	4'T12	2	4	40	Sw	2	261	12	344	180	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	2	261	5	266	104	41	35	75
54	1	Staircase	Chandelier	S	Inc	1	3	60	Sw	10	261	0	180	470	CFL	Chandelier	CFL	S	Sw	1	3	20	10	261	0	60	157	313	0	313
55	1	Staircase	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
56	1	Building Dept	Recessed Parabolic	M	4'T12	2	4	40	Sw	10	261	12	344	898	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	8	261	5	266	521	204	174	377
57	1	Vault Room	Recessed Parabolic	M	8'T12	1	2	80	Sw	2	261	20	180	94	T8	Recessed Parabolic	8'T8	E	Sw	1	2	59	2	261	7	125	65	29	0	29
58	1	Lobby	Sconce	S	CFL	2	2	13	Sw	9	261	0	52	122	N/A	Sconce	CFL	S	Sw	2	2	13	9	261	0	52	122	0	0	0
59	1	Lobby	Recessed Parabolic	M	4'T12	2	4	40	Sw	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	MS	2	4	32	7	261	5	266	469	183	156	339
60	1	Lobby	Flood	S	Inc	3	1	60	Sw	9	261	0	180	423	CFL	Flood	CFL	S	Sw	3	1	20	9	261	0	60	141	282	0	282
61	1	Staircase	Sconce	S	CFL	3	2	13	Sw	9	261	0	78	183	N/A	Sconce	CFL	S	Sw	3	2	13	9	261	0	78	183	0	0	0
62	1	Hallway	Recessed Parabolic	M	4'T12 U-Shaped	2	2	40	Sw	9	261	12	184	432	T8	Recessed Parabolic	4'T8 U-Shaped	E	MS	2	2	32	7	261	5	138	243	108	81	189
63	1	Tax Assessor	Recessed Parabolic	M	4'T12	6	4	40	Sw	10	261	12	1,032	2,694	T8	Recessed Parabolic	4'T8	E	OS	6	4	32	8	261	5	798	1562	611	521	1131
64	1	Bathroom Men	Recessed Parabolic	M	4'T12	2	4	40	OS	10	261	12	344	898	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	10	261	5	266	694	204	0	204
65	1	Bathroom Women	Recessed Parabolic	M	4'T12	2	4	40	OS	9	261	12	344	808	T8	Recessed Parabolic	4'T8	E	OS	2	4	32	9	261	5	266	625	183	0	183
66	1	Storage Closet	Ceiling Mounted	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Mounted	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
67	Bsmt	Hallway	Recessed Parabolic	M	4'T12	1	2	40	OS	2	261	12	92	48	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	2	261	5	69	36	12	0	12

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
68	Bsmt	Hallway	Recessed Parabolic	M	4'T12	2	1	40	OS	2	261	12	104	54	T8	Recessed Parabolic	4'T8	E	OS	2	1	32	2	261	5	74	39	16	0	16
69	Bsmt	Hallway	Recessed Parabolic	M	8'T12	1	2	80	OS	2	261	20	180	94	T8	Recessed Parabolic	8'T8	E	OS	1	2	59	2	261	7	125	65	29	0	29
70	Bsmt	Elevator Mech. Rm	Recessed Parabolic	M	4'T12	1	2	40	Sw	10	261	12	92	240	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	8	261	5	69	135	60	45	105
71	Bsmt	Elevator Mech. Rm	Recessed Parabolic	S	Inc	1	1	150	Sw	10	261	0	150	392	CFL	Recessed Parabolic	CFL	S	OS	1	1	50	8	261	0	50	98	261	33	294
72	Bsmt	File Room	Recessed Parabolic	M	4'T12	4	2	40	OS	9	261	12	368	864	T8	Recessed Parabolic	4'T8	E	OS	4	2	32	9	261	5	276	648	216	0	216
73	Bsmt	File Room	Recessed Parabolic	M	4'T12	1	2	40	Sw	9	261	12	92	216	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	5	69	122	54	41	95
74	Bsmt	Storage	Ceiling Mounted	S	Inc	3	1	150	Sw	10	261	0	450	1,175	CFL	Ceiling Mounted	CFL	S	OS	3	1	50	8	261	0	150	294	783	98	881
75	Bsmt	Mechanical Rm	Recessed Parabolic	M	4'T12	2	2	40	OS	2	261	12	184	96	T8	Recessed Parabolic	4'T8	E	OS	2	2	32	2	261	5	138	72	24	0	24
76	Bsmt	Mechanical Rm	Ceiling Mounted	S	Inc	1	1	100	Sw	10	261	0	100	261	CFL	Ceiling Mounted	CFL	S	OS	1	1	35	8	261	0	35	69	170	23	192
77	Bsmt	Hallway	Recessed Parabolic	M	6'T12	1	2	55	OS	9	261	17	127	298	T8	Recessed Parabolic	6'T8	E	OS	1	2	48	9	261	6	102	240	59	0	59
78	Bsmt	Storage Closet	Recessed Parabolic	M	4'T12	1	2	40	Sw	2	261	12	92	48	T8	Recessed Parabolic	4'T8	E	Sw	1	2	32	2	261	5	69	36	12	0	12
79	Bsmt	Hallway	Recessed Parabolic	M	4'T12	1	2	40	OS	2	261	12	92	48	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	2	261	5	69	36	12	0	12
80	Bsmt	Storage Rm	Recessed Parabolic	M	4'T12	4	4	40	Sw	9	261	12	688	1,616	T8	Recessed Parabolic	4'T8	E	OS	4	4	32	7	261	5	532	937	366	312	679
81	Bsmt	Storage Rm	Recessed Parabolic	M	4'T12	9	4	40	Sw	9	261	12	1,548	3,636	T8	Recessed Parabolic	4'T8	E	OS	9	4	32	7	261	5	1197	2109	824	703	1527
82	1	Staircase	Sconce	S	Inc	1	2	60	Sw	9	261	0	120	282	CFL	Sconce	CFL	S	Sw	1	2	20	9	261	0	40	94	188	0	188
83	Bsmt	Staircase	Recessed Parabolic	M	4'T12	1	2	40	Sw	9	261	12	92	216	T8	Recessed Parabolic	4'T8	E	OS	1	2	32	7	261	5	69	122	54	41	95
84	2	Vault Room	Recessed Parabolic	M	8'T12	1	2	80	Sw	2	261	20	180	94	T8	Recessed Parabolic	8'T8	E	Sw	1	2	59	2	261	7	125	65	29	0	29
85	2	Staircase	Sconce	S	CFL	2	2	13	Sw	9	261	0	52	122	N/A	Sconce	CFL	S	Sw	2	2	13	9	261	0	52	122	0	0	0
86	Ext	Exterior	Sconce	S	Inc	6	1	150	Sw	9	261	0	900	2,114	CFL	Sconce	CFL	S	PC	6	1	50	7	261	0	300	529	1409	176	1586
87	1	Side entrance	Recessed	S	Inc	1	2	150	Sw	9	261	0	300	705	CFL	Recessed	CFL	S	Sw	1	2	50	9	261	0	100	235	470	0	470
88	Ext	Exterior	Wall Mounted	S	MH	8	1	150	PC	12	261	42	1,536	4,811	PSMH	Wall Mounted	PSMH	S	PC	8	1	100	12	261	20	960	3007	1804	0	1804
89	1	Staircase	Recessed Parabolic	M	4'T12	1	4	40	Sw	9	261	12	172	404	T8	Recessed Parabolic	4'T8	E	BL	1	4	32	0	261	5	133	183	92	130	221
Totals:						**294**	**236**	**4,851**				**778**	**43,393**	**104,423**						**294**	**231**	**2,760**			**328**	**30,284**	**53,270**	**36,113**	**15,039**	**51,153**

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

Legend

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

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

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

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

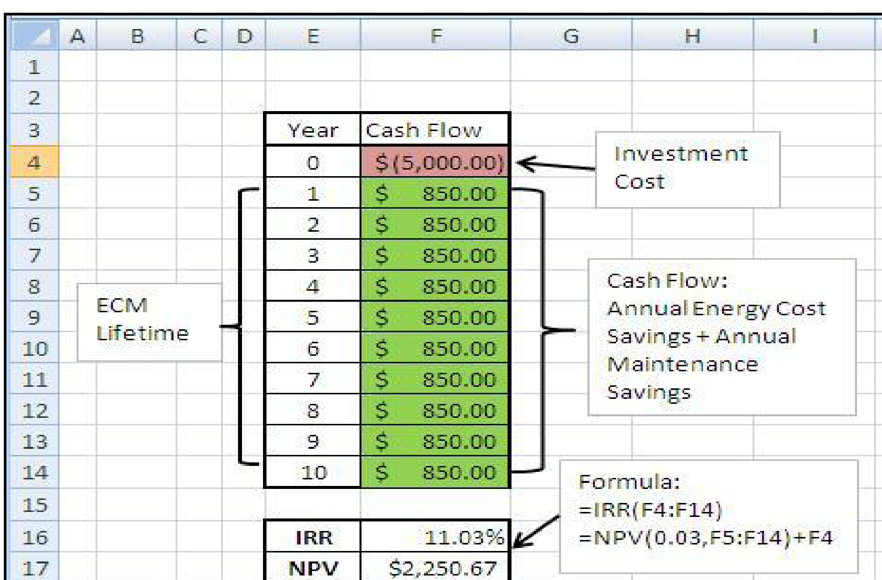
Calculation References

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

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $0.8/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

ENERGY STAR

STATEMENT OF ENERGY PERFORMANCE
Township of Millburn - Town Hall

Building ID: 2243830
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: April 23, 2010

Facility
Township of Millburn - Town Hall
375 Millburn Avenue
Millburn, NJ 07041

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1912
Gross Floor Area (ft^2): 13,358

Energy Performance Rating[2] (1-100) 23

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	729,953
Natural Gas (kBtu)[4]	849,074
Total Energy (kBtu)	1,579,027
Energy Intensity[5]	
Site (kBtu/ft^2/yr)	118
Source (kBtu/ft^2/yr)	249
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	156
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	88
National Average Source EUI	185
% Difference from National Average Source EUI	35%
Building Type	Office

Stamp of Certifying Professional

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

Meets Industry Standards[6] for Indoor Environmental Conditions:

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

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

Direct Install 2010 Program

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 80%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program

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

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

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

Utility Sponsored Programs

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

Federal and State Sponsored Programs

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

APPENDIX G: ENERGY CONSERVATION MEASURES

ECM Counter		ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st year cost 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, $	CO2 reduced, lbs/yr
2	0 to 5 Year Payback ECM	12 New LED exit sign fixtures to be installed with incentives	1,266	240	1,026	9,145	1.9	0	2.3	0	1,546	15	23,183	0.7	2,160	144	151	17,160	16,374
1		39 New CFL fixtures to be installed	1,562	0	1,562	7,331	1.5	0	1.9	35	1,274	5	6,370	1.2	319	64	77	4,239	13,126
10		Install Programmable Thermostat	2,900	0	2,900	2,388	0.6	445	3.9	0	935	12	11,225	3.1	287	24	31	6,301	9,182
4		38 New occupancy sensors to be installed with incentives	8,360	760	7,600	13,204	2.8	0	3.4	0	2,231	15	33,472	3.4	340	23	28	18,658	23,642
8		Retro-commissioning of HVAC systems	16,698	0	16,698	8,012	2.1	890	8.7	1,820	4,238	12	50,853	3.9	335	28	23	24,986	24,158
3		8 New pulse start metal halide fixtures to be installed with incentives	3,395	200	3,195	1,804	0.4	0	0.5	413	718	15	10,768	4.5	431	29	20	5,252	3,230
		TOTALS	**34,181**		**32,981**	**41,884**	**9.3**	**1,335**	**20.7**	**2,268**	**10,942**		**135,871**	**3.0**	**-**	**-**	**-**	**-**	**89,711**
11	5 to 10 Year Payback	Replace (1) electric DHW with a Natural gas Direct Vent model	2,150	50	2,100	3,050	0.8	-104	0.0	0	391	12	4,694	5.4	124	10	15	1,748	4,315
6		6 New motion sensors to be installed with incentives	1,320	120	1,200	1,068	0.2	0	0.3	0	180	15	2,707	6.6	126	8	11	924	1,912
7		6 New bi-level fixtures to be installed with incentives	1,035	150	885	592	0.1	0	0.2	0	100	15	1,501	8.8	70	5	5	292	1,060
5		224 New T8 fixtures to be installed with incentives	39,533	6,720	32,813	17,832	3.7	0	4.6	363	3,377	15	50,649	9.7	71	5	3	6,920	31,928
9		Replace condensing units	3,680	322	3,358	2,014	0.5	0	0.5	0	340	12	4,084	9.9	22	2	3	-10	3,606
		TOTALS	**47,718**	**7,362**	**40,356**	**24,556**	**5.3**	**-104**	**5.6**	**363**	**4,389**		**63,636**	**9.2**	**-**	**-**	**-**	**-**	**42,821**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

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

Disclaimer

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

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