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Local Government Energy Program
Energy Audit Final Report

For

The Municipal Building
Township of Hopewell
Titusville, NJ 08560

Project Number: LGEA14

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INTRODUCTION

On July 9th, August 6th and 7th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Township of Hopewell municipal buildings. The audit included a review of the Municipal Building, the Athletic Complex, the Union Fire and Rescue building, the Public Works Garage, the Princeton Farms Pump Station, and the Brandon Farms Pump Station. The buildings are located in Titusville and Pennington, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Municipal Building located at 201 Washington Crossing - Pennington Rd, Titusville, NJ 08560. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Municipal Building was built in 1963 and houses township administrative offices, a court room, and the Police Department. The building was renovated in 1986 with several minor upgrades to the infrastructure and mechanical systems. The building consists of 35,501 square feet of conditioned space. The building houses approximately 55 day staff employees and 5 overnight Police Department employees.

The majority of the building is administrative and operated Monday through Friday 8:30 am to 5:00 pm. There are committee meetings and night court every other night from 6:00 pm to 10:00 pm. The Police Department accounts for approximately a third of the building and operates 24 hours / 7 days per week.

The goal of this energy audit is to provide sufficient information to the Township of Hopewell to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Municipal Building.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses The Municipal Building located at 201 Washington Crossing - Pennington Rd, Titusville, NJ 08560. The Municipal Building is a one story building (with basement) with a combined floor area of 35,501 square feet. The original structure was built in 1963 and renovated in 1986.

Based on the field visits performed by the SWA staff on July 9th, August 6th and 7th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

In 2008, the most recent year, the Municipal Building consumed 497,400 kWh or $75,577 worth of electricity and 13,608 therms or $20,575 worth of natural gas. The joint energy consumption for the building, including both electricity and natural gas, was 3,058 MM-Btus of energy that cost a total of $96,152.

SWA benchmarked the Municipal Building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building performance rating received is a score of 70 when compared to other buildings of its kind. This indicates that there are good opportunities for the Municipal Building to decrease energy (natural gas or electric use or a combination thereof) use by 5% to reach the Energy Star benchmark rating of 75. Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance.

Based on the assessment of the Department of Public Works, SWA has separated the recommendations into three categories. These are summarized as follows:

Category I Recommendations: Capital Improvements

- Upgrade 125 kVA Generator - The 125 kVA emergency generator is within 3 years of the end of its useful operating life. It only backs up a third of building lights, emergency communication and minimal AC. Since the Municipal Building has been designated as a secondary (to the schools) emergency and shelter back-up for the Township, consideration should be given to upgrading the existing generator to 250 kVA. Also, this will open up the opportunity for the Municipal Building to enroll in a Demand Response Program. The Township of Hopewell could then negotiate with the utility reimbursement for the capability of curtailing power usage.
- Premium Motors - Upgrade circulator pumps to premium efficiency motors when replacing them at the end of their useful operating lives. This cannot be justified at this time on energy savings alone.
- Window Replacement - SWA recommends, as part of a capital improvement plan replacing all windows with newer models with thermal breaks, dual glazing and a low-e rating.
- Upgrade / Protect Exterior Walls - SWA recommends as part of a capital improvement plan to install weep holes and install proper flashing.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all rooftop equipment and heat pumps serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend upon

the capabilities of the existing building automation control system. Energy / cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control.

- Programmable thermostats - Many of the building thermostats are manual and not programmable. There could be opportunities to contain the cooling / heating to only areas that require it per an advanced agreed upon schedule, implement setbacks and thermostat upgrades.
- Boiler Room Piping Insulation - Insulate hot water piping to efficiently deliver heat where required.
- Roof Maintenance - SWA recommends regular maintenance to verify water is draining correctly. SWA suggests contacting the roofing installer to correct areas with insufficient slope as needed.
- Proper Incoming Power and Phases - Periodically check and record incoming power on each phase to insure consistency of voltage delivered to the building. Improper phase balance can affect performance of small sensitive equipment with ballasts / transformers inside the building.
- Weather Stripping / Air Sealing - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & Controls - There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information.

Category III Recommendations: Energy Conservation Measures - Upgrades with associated energy savings

At this time, SWA recommends a total of **6** Energy Conservation Measures (ECMs) for the Municipal Building that are summarized in the following table. The total investment cost for these ECMs with incentives is **$129,881**. SWA estimates a first year savings of **$61,699** with a simple payback of **2.1 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the Municipal Building by **146,132 lbs of CO_2.**

There are various incentives that the Township of Hopewell could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Municipal Building apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, to be rolled out soon, could also assist to cover 80% of the capital investment.

Specifically, the building could qualify for $1,240 for installing the recommended wall-mounted occupancy sensors. The Municipal Building could also take advantage of incentives based on the installation of a photovoltaic (PV) system. Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive program that would pay $5,000 for the installation of a 5kW PV system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1,000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. $3,600 of SRECs may be received annually; however it requires proof of performance, application approval and negotiations with the utility. Wind Upfront Incentive Program, Expected performance buy-down (EPBB) is modeled on an annual kWh production of 1-16,000 kWh and may pay $3.20/kWh upfront incentive level. However, it requires proof of performance, application approval and negotiations with the utility. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV or Wind system through a loan issued by PSE&G.

The following tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

PROPOSED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
1	Install Drinks Vending machine misers	$795	www.usatech.com	3,611	kWh	0.7	-	549	1.4	12	5,399	48.3	4,947
2.1	replace 29 Incand lamps to CFL	$580	RS Means, Lit Search	3,191	kWh	0.6	kW	485	1.2	7	3,000	59.6	4,372
2.2	install 57 occupancy sensors with INCENTIVES	$5,130	RS Means, Lit Search, NJ Clean Energy Program	12,201	kWh	2.2	kW	1,854	2.8	12	18,241	21.3	16,715
3	Retro-Commission-ing	$44,376	Similar Projects	49,740	kWh	9.1	kW	9,594	4.6	12	94,373	9.4	83,904
				1,347	therms	-	-						
4	Install VFD on cooling tower fan motor	$9,000	Similar Projects	7,517	kWh	1.4	kW	1,143	7.9	12	11,239	2.1	10,298
5	Install 5 kW Wind System with INCENTIVE	$40,000	Similar Projects	13,000	kWh	5.0	kW	43,576	0.9	25	742,159	70.2	17,810
6	Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,497	6.7	25	76,592	6.2	8,086
	Total Proposed	**$129,881**	-	-	-	**24.0**	**kW**	**$61,699**	**2.1**	**19**	**867,781**	**29.9**	**146,132**

Definitions: SPP – Simple Payback (years)
LoM: Life of Measure (years)
ROI: Return on Investment (%)

Assumptions: Discount Rate: 3.2% per DOE FEMP Guidelines
Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

CONSIDERED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
2.3	replace building internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	$13,690	RS Means, Lit Search, NJ Clean Energy Program	6,544	kWh	1.2	kW	995	13.8	20	14,528	0.3	8,965

Definitions:
SPP – Simple Payback (years)
LoM: Life of Measure (years)
ROI: Return on Investment (%)

Assumptions:
Discount Rate: 3.2% per DOE FEMP Guidelines
Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

1. HISTORIC ENERGY CONSUMPTION

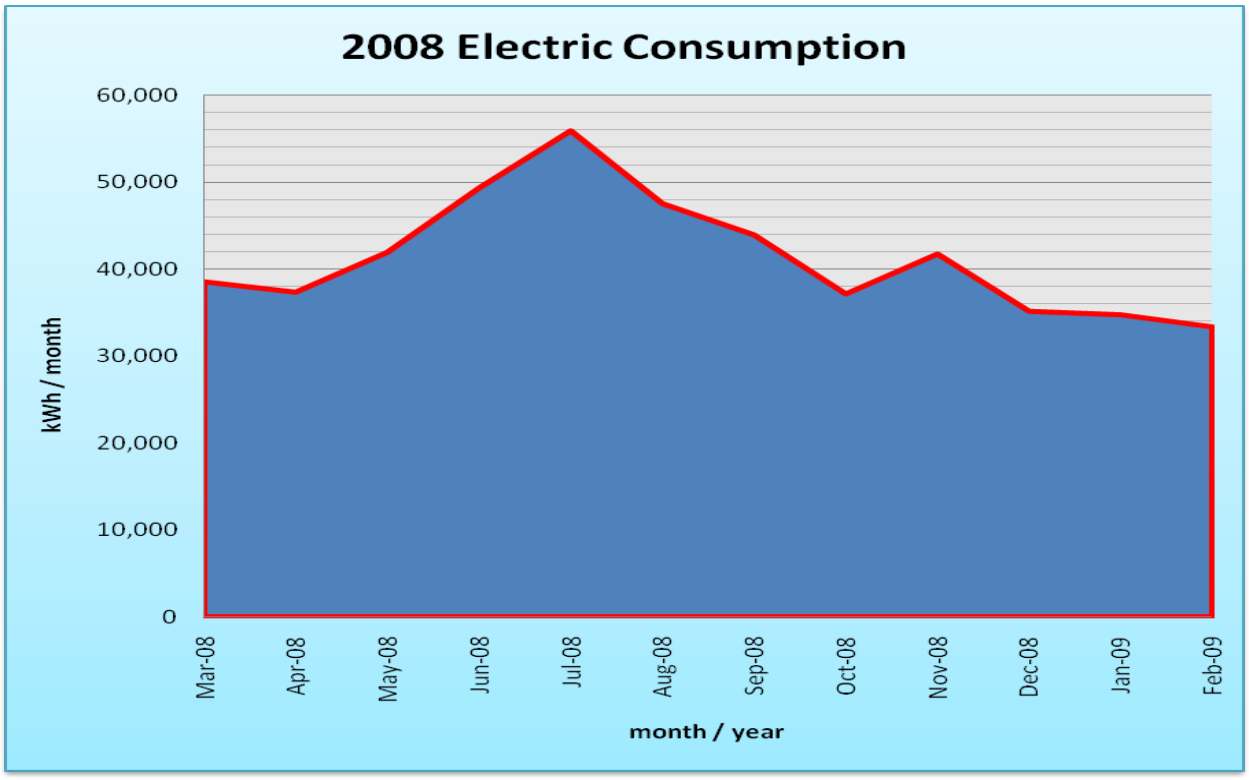
1.1. Energy usage and cost analysis

SWA analyzed utility bills from September 2007 through August 2009 that were received from the utilities supplying the Municipal Building with electric and natural gas.

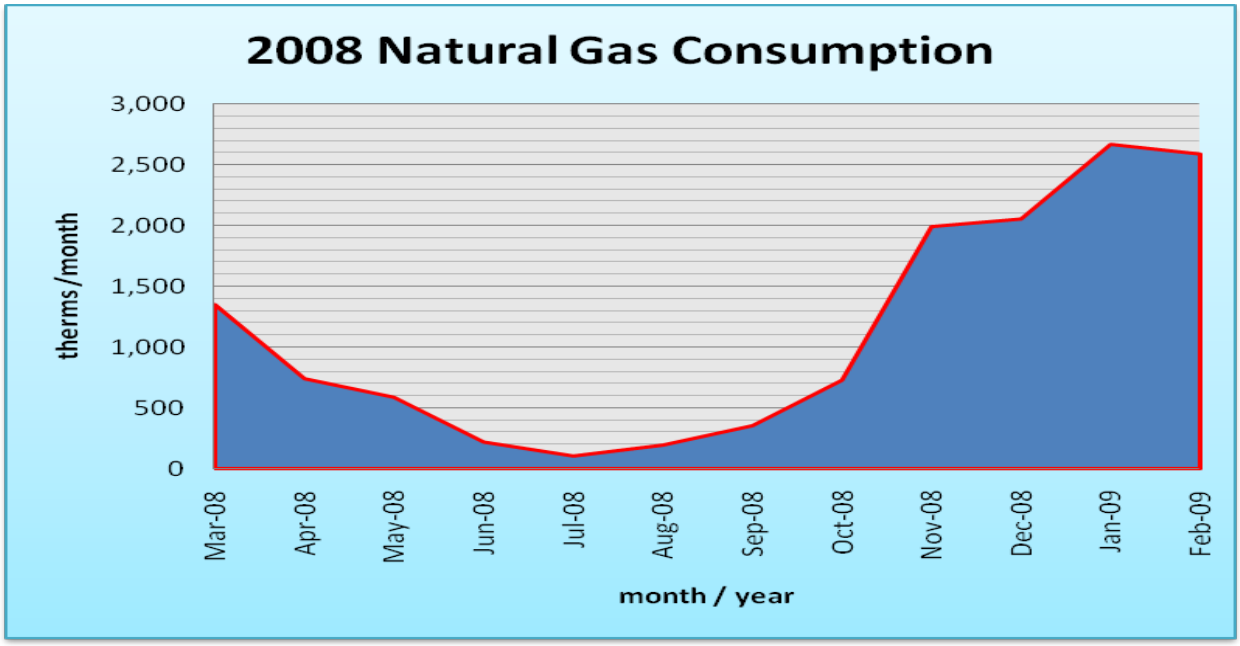
Electricity - The Municipal Building is currently served by one electric meter. The Municipal Building currently buys electricity from PSE&G at **an average rate of $0.152/kWh** based on 12 months of utility bills for 2008. The Municipal Building purchased **approximately 497,400 kWh or $75,577 worth of electricity** in the previous year. The average monthly demand was 93 kW.

Natural Gas - The Municipal Building is currently served by one meter for natural gas. The Municipal Building currently buys natural gas from Elizabethtown Gas Co. at **an average aggregated rate of $1.51/therm** based on 12 months of utility bills for 2008. The Municipal Building purchased **approximately 13,608 therms or $20,575 worth of natural gas** in the previous year.

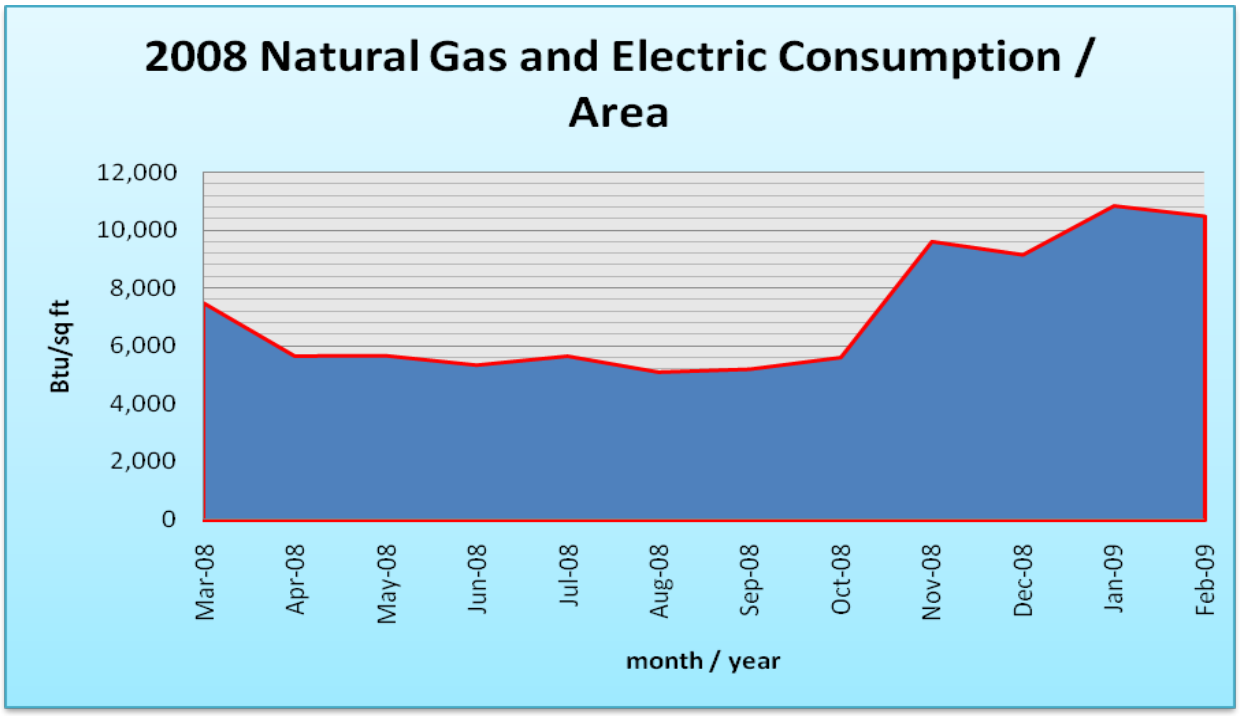
The following chart shows electricity use for the Municipal Building based on utility bills for the 12 month period of March 2008 - February 2009.



The following chart shows the natural gas consumption for the Municipal Building based on utility bills for the 12 month period of March 2008 - February 2009.

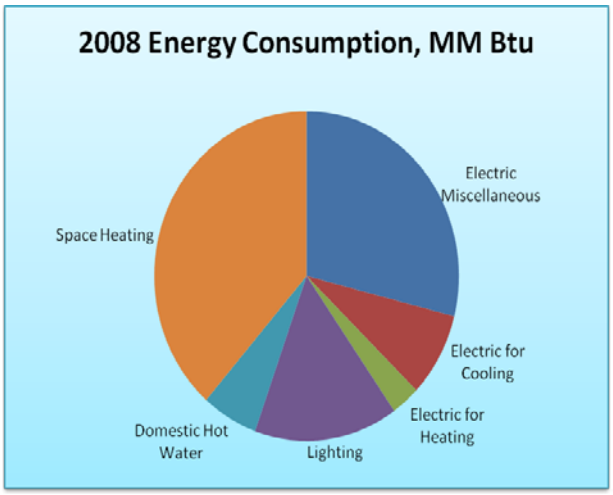


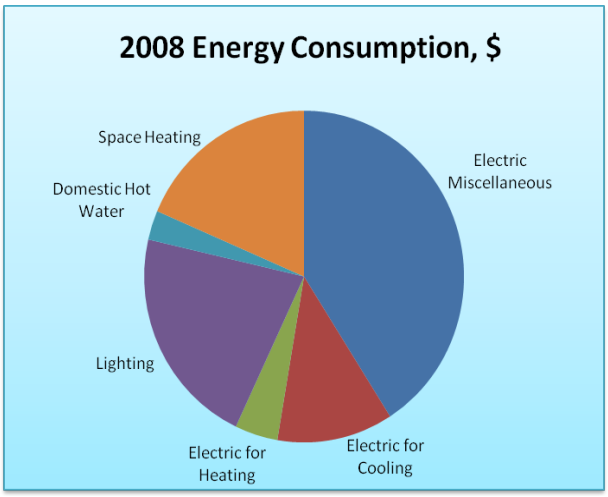
The following chart shows combined natural gas and electric consumption in Btu/ft2 for the Municipal Building, based on utility bills for the 12 month period of March 2008 - February 2009.



The following table and chart pies show energy use for the Municipal Building based on utility bills for the 12 month period of March 2008 - February 2009. Note electrical cost at $45/MM-Btu of energy is approximately 3 times as expensive to use as natural gas at $15/MM-Btu. It is assumed that the electrical miscellaneous usage includes building fans that operate throughout the year.

2008 Annual Energy Consumption / Costs					
	MM Btu	% MM Btu	$	% $	$/MM Btu
Electric Miscellaneous	885	29%	$39,404	41%	$45
Electric for Cooling	253	8%	$11,244	12%	$45
Electric for Heating	93	3%	$4,163	4%	$45
Lighting	466	15%	$20,766	22%	$45
Domestic Hot Water	182	6%	$2,755	3%	$15
Building Space Heating	1,179	39%	$17,821	19%	$15
Totals	3,058	100%	$96,152	100%	$31
Total Electric Use	1,697	56%	$75,577	79%	$45
Total Gas Use	1,361	44%	$20,575	21%	$15
Totals	3,058	100%	$96,152	100%	$31





1.2. Utility rate

The Municipal Building currently purchases electricity from PSE&G Electric at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Municipal Building currently pays an average rate of approximately $0.152/kWh based on 12 months of utility bills for 2008.

The Municipal Building currently purchases natural gas supply from Elizabethtown Gas Co. at a general service market rate for natural gas (therms). Elizabethtown Gas Co. acts also as the transport company. There is one gas meter that provides natural gas service to the Municipal Building currently. The average aggregated rate (supply and transport) for the meter is approximately of $1.51/therm based on 12 months of utility bills for 2008.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3. Energy benchmarking

The Municipal Building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy benchmarking system. The building performance rating received is a score of 70 when compared to other buildings of its kind. This indicates that there are good opportunities for the Municipal Building to decrease energy (natural gas or electric use or a combination thereof) use by 5% to reach the Energy Star benchmark rating of 75.

Buildings achieving an Energy Star rating of 75 or higher and professionally verified to meet current indoor environmental standards are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance to the community, taxpayers, and employees. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification to the United States Green Building Council (USGBC). Per the LGEA program requirements, SWA has assisted the Township of Hopewell to create an *Energy Star Portfolio Manager* account and share the Municipal Building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Township of Hopewell (user name of "hopewelladmin" with a password of "hopewelltwp1") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Hopewell - Municipal Building

Building ID: 1811454
For 12-month Period Ending: January 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: September 14, 2009

Facility
Township of Hopewell - Municipal Building
201 Washington Crossing-Pennington Road
Titusville, NJ 08560

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1963
Gross Floor Area (ft²): 35,501

Energy Performance Rating[2] (1-100) 70

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,759,361
Natural Gas (kBtu)[4]	1,293,700
Total Energy (kBtu)	3,053,061

Energy Intensity[5]

Site (kBtu/ft²/yr)	86
Source (kBtu/ft²/yr)	204

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	337

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	110
National Average Source EUI	260
% Difference from National Average Source EUI	-22%
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.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Municipal Building ground floor and basement were renovated in 1986. The building consists of 35,501 square feet of conditioned main space. The Municipal Building, built in 1963, houses the following function areas: administrative offices (approximately 67% of the space), a court room, health department, the planning and construction department, zoning, purchasing, and the Police Department.

2.2. Building occupancy profiles

The peak occupancy for the Municipal Building is approximately 55 employees during the daytime plus visitors to various Municipal Departments and the Court Room when it is in session. The administrative part of the building is normally operated Monday - Friday 8:30 am to 5:00 pm and also every other night for court sessions and committee meetings (6:00 pm to 10:00 pm). The Police Department operates 24 hours / 7 days a week with 5 employees working the overnight shift.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist of 8" CMU blocks with either a brick veneer or EIFS (Exterior Insulated Finishing System) façade. The original structure consists of masonry wall construction whereas the 1986 addition was built of masonry and metal stud wall assemblies. Due to warm temperature conditions at the time of the field visits, insulation levels could not be verified with help of infrared technology. If desired, the Municipality could contract a separate envelope inspection during cooler months.

The exterior wall assemblies showed a lack of proper drainage and flashing. No obvious weep holes were detected, which would allow water to exit the wall assemblies. Water damage and mildew are shown on the below images and in various locations on the exterior walls. Water damage is also evident on interior walls, such as in the image below in the basement gym area. SWA recommends as part of a capital improvement plan to install weep holes and install proper flashing.

2

S eplaced in 2000. There appears to be a few areas where water has
P outs or insufficient pitch. SWA recommends regular maintenance
t ly. SWA suggests verifying the terms of the roof warranty and
c orrect areas with insufficient slope as needed.

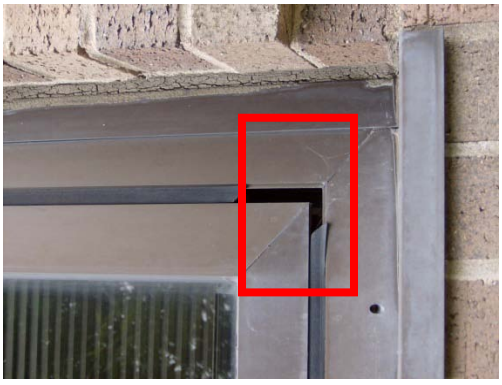
As previously noted, due to a lack of gutters or downspouts, water is draining off the sloped roof through small drip holes and creating mildew stains on the exterior walls (seen in the images below). Due to the ambient temperature during SWA's visit, SWA could not conduct infrared imagery in order to determine the quantity of water that may be contained and trapped in the wall cavities. SWA recommends correcting the issue either by modifying the roof slope so water drains from roof drainage or by installing gutters and downspouts.

2.3.3. Base

The building's base is a 4" concrete slab-on grade with a perimeter footing. There weren't any reported problems with water penetration or moisture. The slab edge or perimeter insulation could not be verified and should be confirmed at the time of the above recommended insulation inspection during cooler months for usable infrared data evaluation.

2.3.4. Windows

The building contains fixed and casement aluminum-framed windows with single-glazing. The windows, original to the building are energy in-efficient. The majority of the windows have worn out seals. The window seals are of great concern as infiltration, water, and pests such as the bees (seen in the image below) are allowed to enter the building. During SWA's visit, SWA noted multiple window locations serving as points of entries for the bees. SWA recommends, as part of a capital improvement plan replacing all windows with newer models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows.



2.3.5. Exterior doors

The aluminum framed exterior doors were observed to be in good condition except for some missing or worn weather-stripping. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of expensive conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

2.3.6. Building air tightness

Based on a visual inspection, the Municipal building could benefit from tightly sealed windows and doors, ductwork, plumbing, and wire penetrations. Any water damage due to condensing un-insulated pipes, condensate lines dripping, plumbing leaks, or roof leaks should be repaired immediately and ceiling tiles should be replaced. Ceiling tiles act as an air barrier containing expensive conditioned air from leaking into ceiling or wall cavities.

2.4. HVAC Systems

2.4.1. Heating

The heating system consists of three boilers model PFG-6-PI, with an input capacity of 325,000 BTUH, output capacity of 253,500 BTUH, and an IBR rating of 220,669 manufactured by Weil McLain. The thermal efficiency of the boilers is 81% AFUE. Two of the boilers are scheduled to be replaced in kind. The replacement boilers were delivered to the building at the time of SWA's audit visit. SWA recommends a condensing boiler for the third unit when it is time to replace it, since it is a good fit for a water source heat pumps system.

The boilers provide hot water to the water source heat pump system, the convectors, cabinet unit heaters and unit heaters serving the stairs and the mechanical spaces.

Many of the building thermostats are manual and not programmable. There could be opportunities to contain the cooling / heating to only areas that require it per an advanced agreed upon schedule, implement setbacks and thermostat upgrades. SWA also recommends retro-commissioning the HVAC equipment and especially the associated controls to insure that they are operating at the designed efficiency.

2.4.2. Cooling

A system of water source heat pump units provides cooling for the Municipal Building. The condenser water is circulated between the cooling tower and the heat exchanger by a 7.5 HP, 255 GPM, 60 ft head pump. The pump is manufactured by Weisman. The cooling tower is model VTO-102-L, manufactured by Baltimore Aircoil. Makeup water is delivered to the cooling tower from a storage tank installed in mechanical room on the lower level by a pump (65 GPM, 140 FT, type 341A-DF, size: 1.5x2x12, manufactured by Aurora Pump).

The heat exchanger is model HK6-6.5-2-H, manufactured by Baltimore Aircoil. The heat exchanger was cleaned in 2005. The condenser water is circulated between heat exchanger and heat pump units by a Weisman pump. There is also a stand-by pump serving both systems.
There is a water control system that controls the cooling tower and pump operations. The cooling tower operates in two stages.

The court room is cooled by a dedicated roof top unit.

There are also six 6 mini split systems serving various spaces of the building.

2.4.3. Ventilation

The Municipal building is provided with an outside air via a 12-Ton RTU make-up air unit. The make-up air unit is model 39LA1101CB1B31-L, manufactured by Carrier. The make-up air unit is provided with two duct mounted heaters, manufactured by Reznor, and with a DX coil.

The condensing unit serving the make-up air unit is model 38AE-014, manufactured by Carrier.
Conditioned outside air is delivered to the building via a ductwork system thru ceiling mounted grilles.

2.4.4. Domestic Hot Water

A gas fired A. O. Smith domestic hot water heater, model BTR 154 with an input of 154 MBH, a recovery of 149 MBH and an 81 gal tank provides hot water to the building via a recirculation pump.

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating and decreased water and sewer bills. SWA recommends adding controlled on- / off- timers on all lavatory faucets to reduce both cold and domestic hot water consumption. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Municipal Building currently consists of mostly T8 fluorescent fixtures with electronic ballasts with a few areas not yet retrofitted from T12 to T8 fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-lighted areas. SWA recommends replacing T12 lighting including magnetic ballasts whenever possible with T8 lighting and electronic ballasts. As this option may not be very cost effective, the changeover could take place as fixtures break down and are taken out of service. SWA also recommends installing occupancy sensors in bathrooms, offices and areas that are occupied only part of the day. Since bathrooms are used sporadically throughout the day and lighting is commonly left on far beyond the necessary hours of operation, SWA recommends installing occupancy sensors with time delay and acoustic capabilities. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period. The building also has a few lights with incandescent bulbs. SWA recommends replacing all incandescent bulbs with CFLs. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - The building has mostly LED exit signs installed. These are low energy users. SWA recommends that any newly installed exit signs be LED type exit signs.

Exterior Lighting - The exterior lighting was surveyed during the building audit, and it is a mix of incandescent, high pressure sodium and metal halide lamps. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace exterior high pressure sodium and metal halide lamp lighting at this time. SWA highly encourages change-out of incandescent lamps to CFLs. All exterior lighting is controlled by astronomical timers. There is not any immediate need to upgrade these lighting or astronomical timers.

Building Exterior Sign Lighting - There are 3 building signs which are lighted at night and also mark the entrance roads to the Municipal Building. These signs are each internally lighted by four T12 10 ft long bulbs. SWA recommends replacing the T12 lamps with T8s. Alternatively, the signs can be left un-lighted, however road bollard or pole lighting installation can be quite expensive and the net result will not provide significant electrical savings.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Look for the Energy Star label when replacing appliances and equipment, including: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Municipal Building computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3. Elevators

The Municipal Building is served by a Dover hydraulic elevator that goes between the basement and first floor.

The elevator performance needs to be evaluated at a minimum on an annual basis. On a regular basis, preventive maintenance procedures and methods for evaluation of both mechanical and electrical components should be conducted. This includes cleaning, adjusting and lubricating various components to assure continued operation and speed performance as well as procedures for recording and evaluating these items. Test instruments such as tachometer light meters, ammeters, multi-meters, pressure gauges, force gauges, and special tools will be needed to conduct the maintenance work. Performance evaluations shall be conducted, including: checking floor to floor time, car speed, accelerations / deceleration, and door operation. Elevator safety features need to be addressed by the inspection personnel.

2.5.4. Others electrical systems

There is 125 kVA emergency generator serving mainly the Police Department and as an emergency generator serving the rest of the Municipal Building. Since the Municipal Building has been designated as a secondary (to the schools) emergency and shelter back-up for the Township, consideration should be given to obtaining and upgrading the existing generator to a 250 kVA generator to back-up office of emergency management and total building. The existing generator only backs up a third of building lights, emergency communication and minimal AC.

There are not currently any other electrical systems installed at the Municipal building.

SWA has been told that the Municipal Building goes through relatively a lot of lamp bulb and ballast changes throughout the year. SWA recommends that the Municipal Building records incoming power phases to the building. Perhaps, ask the utility company, PSE&G, to megger feeds to the main transformer buses. On the whole, megger testing is non destructive. What happens is a DC voltage is applied to the cable under test. It is an insulation test to see if the insulation has been compromised in any way to cause a short circuit when normal power is applied to it. There may be some phase in-balance and / or grounding and recent heavy rains are making the situation worse. Also determine if weekly generator tests are shortening the life of light bulbs in the building. The Township may also want to investigate surge suppressors for the main transformer. Many of the places SWA visits are very happy with the T8s and have not changed any ballasts for long periods of time.

3. EQUIPMENT LIST

Inventory

The Municipal Building Township of Hopewell						
Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Estimated Remaining Useful Life %**
Elevator	Transport between the 2 levels - hydraulic	front lobby to lower level	Dover	Electric	Municipal Bldg	10%
Heating	3 Weil McLain Boilers input capacity: 325,000 BTUH, output capacity: 253,500 BTUH, IBR rating: 220,660 BTUH, 81% thermal efficiency	boiler room - lower level	PFG-6-PI	Natural Gas	Municipal Bldg	10%
Heating, cooling and ventilation	18 horizontal water source heat pumps on the upper level	distributed - upper level	Climate Masters	Electric	Municipal Bldg	35%
Heating, cooling and ventilation	21 console water source heat pumps on the lower level	distributed - lower level	Climate Masters (R-22 on in old - in the midst of being changed out to new, R-410A in new)	Electric	Municipal Bldg	100% on new only
Cooling	BAC Cooling Tower	rooftop	VTO-102-L	Electric	Municipal Bldg	90%
Cooling	BAC Heat Exchanger	boiler room - lower level	HK6-6.5-2-H	Electric	Municipal Bldg	90%
Heating, cooling and ventilation	Carrier make-up air system with 2 Reznor heaters	rooftop	39LA1101CB1B31-L/38AE-014	Electric / Natural Gas	Municipal Bldg	75%
Heating, cooling and ventilation	2 condensate circulation pumps, 255 gpm, 60 ft head	boiler room - lower level	7.5 HP Weisman	Electric	Municipal Bldg	50%
Heating	3 recirculation pumps	boiler room - lower level	1/2 HP Grunfoss	Electric	Municipal Bldg	10%
Cooling	5 split cooling units	condensers next to bldg	Goodman	Electric	Municipal Bldg - lower level	55%
Domestic Hot Water heater	Manufacturer: A. O. Smith, Input: 154 MBH, Recovery: 149 MBH, 81 gal storage	boiler room - lower level	BTR 154	gas	Municipal Bldg	65%
Generator	125 kVA lower level (backs up emergency lights, servers, fire alarm system, every 3rd corridor light) - tested weekly	next to building	Onan / Kamazu Diesel engine	Natural Gas / Electric	Municipal Bldg	10%
Well Pumps	10 gpm, 170 ft; 180 ft well feeds 750 gal ss tank; booster pump to roof cooling tower	next to building	-	Electric	Municipal Bldg	50%
Sump Pump	2 in boiler room	boiler room - lower level	-	Electric	Municipal Bldg	50%
Lighting	See details - Appendix A	See details - Appendix A	-	Electric	Municipal Bldg	varies, average 60%

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.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Municipal Building, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements - Upgrades not directly associated with energy savings
2. Operations and Maintenance - Low Cost / No Cost Measures
3. Energy Conservation Measures - Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements

- Upgrade 125 kVA Generator - The 125 kVA emergency generator is within 3 years of the end of its useful operating life. It serves mainly the Police Department and only backs up a third of building lights, emergency communication and minimal AC. Since the Municipal Building has been designated as a secondary (to the schools) emergency and shelter back-up for the Township, consideration should be given to obtaining and upgrading the existing generator to a 250 kVA generator to back-up office of emergency management and total building. Also, this will open up the opportunity for the Municipal Building to enroll in a Demand Response Program, due to the capability to shed a minimum of 100 kW electric demand when requested by the utility during peak demand periods. The Township of Hopewell could then negotiate with the utility a reimbursement plan for the capability of curtailing power on demand.
- Premium Motors - Upgrade circulator pumps to premium efficiency motors when replacing them at the end of their useful operating lives. This cannot be justified at this time on energy savings alone.
- Window Replacement - SWA recommends, as part of a capital improvement plan replacing all windows with newer models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows.
- Upgrade / Protect Exterior Walls - SWA recommends as part of a capital improvement plan to install weep holes and install proper flashing.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all rooftop equipment and heat pumps serving key public spaces be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of fresh air conditioned by the equipment. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building automation control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Programmable thermostats - Many of the building thermostats are manual and not programmable. There could be opportunities to contain the cooling / heating to only areas that require it per an advanced agreed upon schedule, implement setbacks and thermostat upgrades.
- Boiler Room Piping Insulation - Insulate un-insulated hot water piping to efficiently deliver heat where required and provide personnel protection.
- Roof Maintenance - SWA recommends regular maintenance to verify water is draining correctly. SWA suggests verifying the terms of the roof warranty and contacting the roofing installer to correct areas with insufficient slope as needed.
- Proper Incoming Power and Phases - Periodically check and record incoming power on each phase to insure consistency of voltage delivered to the building. Improper phase balance can affect performance of small sensitive equipment with ballasts / transformers inside the building.

- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. 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.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information for hosting energy efficiency educational programs and for more information please visit: http://www1.eere.energy.gov/education/

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description
1	**Install Vending Misers on Drinks and Snacks Vending Machines**
2	**Upgrade building lighting: incandescent to CFLs, occupancy sensors for some offices, Exit fluorescents to LED and T12 magnetic fixtures to T8 electronic fixtures**
3	**Undertake retro-commissioning of building systems and controls to optimize performance**
4	**Install VFD on Cooling Tower fan motor**
5	**Install a 5kW Wind system to reduce annual electric consumption and demand**
6	**Install a 5kW PV system to reduce annual electric consumption and demand**

ECM#1: *Install Vending Miser*

Description:

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

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

Installation cost:

Estimated installed cost: $795
Source of cost estimate: www.usatech.com *and established costs*

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $			Cost Savings $		
Install Drinks Vending machine misers	$795	www.usatech.com	3,611	kWh	0.7	-	549	1.4	12	5,399	48.3	4,947

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com. or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

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

ECM#2: *Upgrade Existing Lighting*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Municipal Building (see Appendix A). The existing lighting consists of many T8 fluorescent fixtures with electronic ballasts, and a few incandescent lights and T12s. Many of the lights in the Municipal Building appear to have been upgraded to T8 fixtures and LED lighted Exit signs. SWA has performed an evaluation of upgrading all the T12 magnetic ballast fixtures to T8 electronic ballast fixtures, incandescent bulbs to CFLs and installing occupancy sensors in offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Municipal Building 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. SWA recommends at a minimum that the incandescent bulbs be replaced with CFLs, occupancy sensors be installed in a number of offices and bathrooms. See Appendix A for recommendations.

Installation cost:

Estimated installed cost: $5,710
Source of cost estimate: RS *Means; Published and established costs*

Economics (Some of the options considered with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $			Cost Savings $		
replace 29 Incand lamps to CFL	$580	RS Means, Lit Search	3,191	kWh	0.6	kW	485	1.2	7	3,000	59.6	4,372
install 57 occupancy sensors with INCENTIVES	$5,130	RS Means, Lit Search, NJ Clean Energy Program	12,201	kWh	2.2	kW	1,854	2.8	12	18,241	21.3	16,715
Total Proposed	$5,710		15,392	kWh	2.8	kW	2,340	2.4	11	22,205	25.1	21,087

Economics (Option with incentives considered that do not appear cost effective):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI, %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $			Cost Savings $		
replace building internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	$13,690	RS Means, Lit Search, NJ Clean Energy Program	6,544	kWh	1.2	kW	995	13.8	20	14,528	0.3	8,965

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

Rebates/financial incentives:

NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control)
Maximum incentive amount is $1,240.

NJ Clean Energy - Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities ($10-$30 per fixture, depending on quantity of lamps). Maximum incentive amount is $2,220.

Options for funding the Lighting ECM:

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

ECM#3: *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 Municipal Building have undergone renovations in the last ten years, and the building continues to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. There have been concerns from the Maintenance Department that the control systems are not operating as designed. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. In particular, SWA observed potential energy savings associated with optimizing the scheduled operating hours and outdoor air fraction of rooftop equipment serving large public areas, such as the Court Room. During retro-commissioning, the individual loop temperatures should also be reviewed to identify opportunities for optimizing system performance. Programmable thermostats could be considered for improved setback control.

Installation cost:

Estimated installed cost: $44,376
Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Retro-Commission-ing	$44,376	Similar Projects	49,740	kWh	9.1	kW	9,594	4.6	12	94,373	9.4	83,904
			1,347	therms	-	-						

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Municipal Building. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total square footage of 35,501.

Rebates / financial incentives: *There are currently no incentives for this measure at this time.*

Options for funding ECM:

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

ECM#4: *Install VFD Controls on Cooling Tower Fan Motor*

Description:

Currently, the Municipal Building Cooling Tower (BAC VTO-102-L) operates in conjunction with the heat pump cooling equipment during the summer time. The cooling tower fan system consists of a 15 Hp two-speed motor and drive assembly. The motor is attached and drives the tower fan via V-belts. The motor is controlled by a PLC with input of return water temperature to the cooling tower. Based on the required cooling, the PLC control operates the motor for a given period of time at either the full or half the motor speed.

Baltimore Aircoil Co. also offers Variable Frequency Drives (VFDs) packages for enhanced control with many benefits including:

- Precise leaving fluid temperature control provides a more efficient method to vary airflow compared to fan cycling, fan dampers, or mechanical speed changers.
- Soft-starts, stops, and smooth accelerations prolong the mechanical system (fans, motors, belts, bearings, etc) life while reducing maintenance.
- The soft-start feature minimizes start-up noise and smooth acceleration make the tower sound less noticeable to the neighbors.

Other benefits of such a systems control arrangement are:

- Energy savings by operating the fan at its most efficient design condition, even with variable conditions
- Prevention of motor overload
- Energy cost and utility demand charge savings by eliminating the current surge at fan start for contactor started fans
- Operation of the fan at reduced speeds, which also contributes to overall fan life
- Prevention of "cross-talk" between the drives, which do emit local EMFs, and electronic level sensing devices
- Ethernet communication capabilities, for remote alarms as well as for troubleshooting

Installation cost:

Estimated installed cost: $9,000
Source of cost estimate: Similar projects

Economics:

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install VFD on cooling tower fan motor	$9,000	Similar Projects	7,517	kWh	1.4	kW	1,143	7.9	12	11,239	2.1	10,298

Assumptions: SWA assumed electrical loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction equivalent to a conservative 40% of the total fan electric draw for the Municipal Building, based on the described VFD control scheme, discussions and saving calculations by Baltimore Aircoil.

Rebates/financial incentives:

This measure may qualify for a rebate or financial incentive depending on agreement and interpretation of application. NJ Clean Energy does have incentives for applying variable speed drives to compressors, chilled water pumps and variable air volume fans (65-155/Hp). The maximum incentive amount could be $2,325. Should this be granted, the simple payback for this measure could drop to 5.8 years.

Options for funding ECM:

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

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

ECM#5: *Install 5kW Wind System*

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

ECM#6: *Install 5kW PV System*

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems. The Township of Hopewell is commissioning a 40 kW photovoltaic system located on the lawn of the Public Works Garage.

5.2. Wind

ECM#5: *Install 5kW Wind system*

Description:

Wind power production may be applicable for the Municipal Building location, because of the thermal winds generated in the area. Currently, the Municipal Building does not use any renewable energy systems. Updated renewable energy systems such as "magnetic" vertical axis wind turbines (MVAWT) can be mounted on building roofs offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Wind systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, however does not recommend at this time installing a 5kW Wind system to offset electrical demand for the building and reduce the annual net electric consumption for the building, because there are insufficient guaranteed incentives for NJ rebates at this time to justify the investment. The Municipal Building is also not eligible for a 30% federal tax credit. The Municipal Building may consider applying for a grant and / or engage a Wind Power generator / leaser who would install the Wind system and then sell the power at a reduced rate.

There are many possible locations for a 5kW Wind system installation on top of the building ample roof area. The supplier would need to first determine via recorded analysis at the proposed location(s) consistency and wind speeds available. Area winds of 10 mph will run turbines smoothly and capture the needed power. This is a roof-mounted wind turbine (used for generating electricity) that spins around a vertical axis like a merry-go-round instead of like a windmill, as do more traditional horizontal axis wind turbines (HAWTs). A typical 5kW MVAWT wind system has a 20 ft diameter turbine by 10 ft tall.

The installation of a renewable Wind power generating system could serve as a good educational tool and exhibit for the community. **It is very important that Wind measurements and recordings are taken at**

the chosen location for at least a couple of months to assure that sufficient wind and speed is available for proper operation and to meet incentive requirements.

Installation cost:

Estimated installed cost: $40,000
Source of cost estimate: Similar projects

Economics (with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install 5 kW Wind System with INCENTIVE	$40,000	Similar Projects	13,000	kWh	5.0	kW	43,576	0.9	25	742,159	70.2	17,810

Assumptions: SWA estimated the cost and savings of the system based on past wind projects. SWA projected physical dimensions based on a 5kW-Enviro Energies turbine system. **SWA assumes that the relatively low height (~30 ft) compared to the taller horizontal axis turbines is acceptable to the NJ BPU as long as the average documented annual wind speed is 11 mph at the hub.**

Rebates/financial incentives:

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

NJ Clean Energy - Wind Upfront Incentive Program, Expected performance buy-down (EPBB) is modeled on an annual kWh production of 1-16,000 kWh for a $3.20/kWh upfront incentive level. This has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

5.3. Solar Photovoltaic

ECM#6: *Install 5kW PV system*

Description:

Currently, the Municipal Building 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 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. SWA presents below the economics, however does not recommend at this time installing a 5kW PV system to offset electrical demand for the building and reduce the annual net electric consumption for the building, because there are insufficient guaranteed incentives from NJ rebates at this time to justify the investment. The Municipal Building is also not eligible for a 30% federal tax credit. The Municipal Building 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. PSE&G provides the ability to buy SRECs at $600 / MWh or best market offer.

There are many possible locations for a 5kW PV installation on the building roofs. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 5kW system needs approximately 41 panels which would take up 435 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: $30,000
Source of cost estimate: Similar projects

Economics (with some incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $			Cost Savings $		
Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,497	6.7	25	76,592	6.2	8,086

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 by Sharp Electronics (123 Watts, model #ND-123UJF). 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 $1.00 / watt Solar PV application. Incentive amount for this application is $5,000.
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 1000kWh (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. $3,600 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of existing split system cooling, HW boilers and insufficient domestic hot water use.

5.6. Geothermal

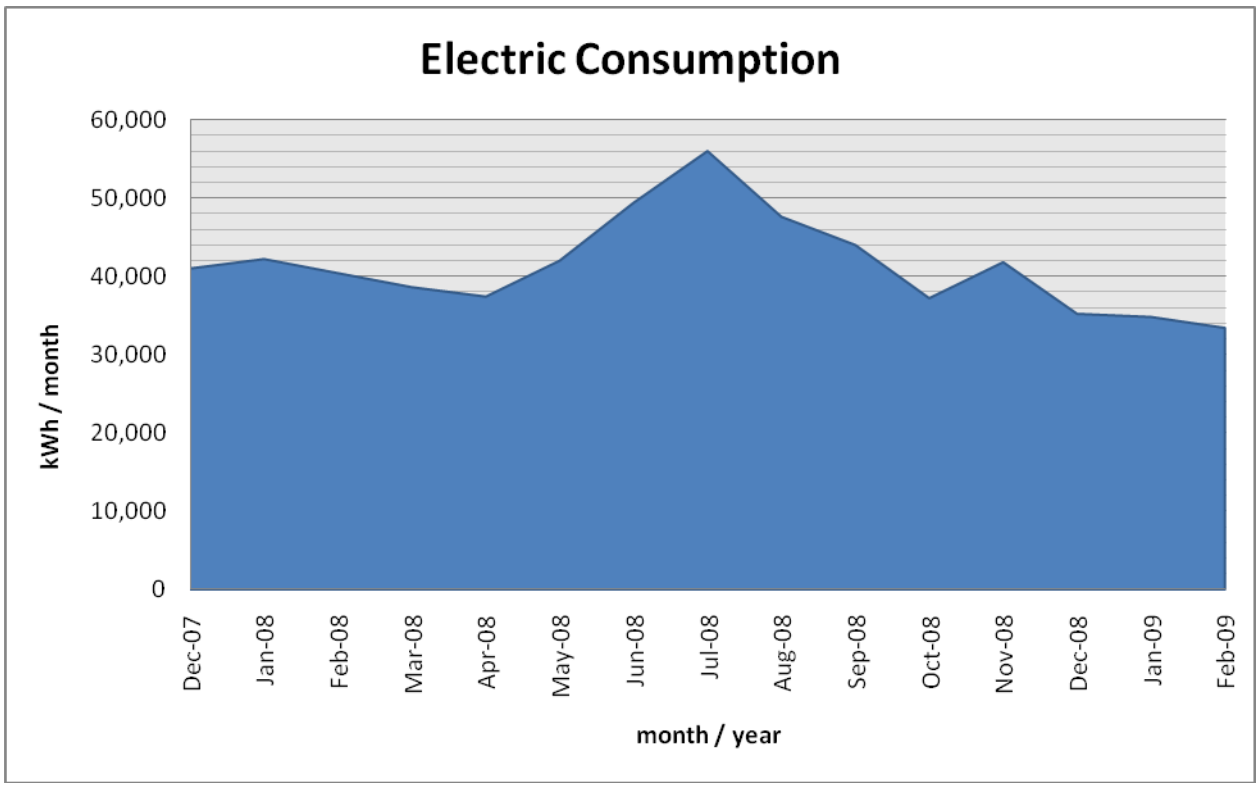
Description:

Geothermal is not applicable for this building because it would not be cost effective to change to a geothermal system at this location.

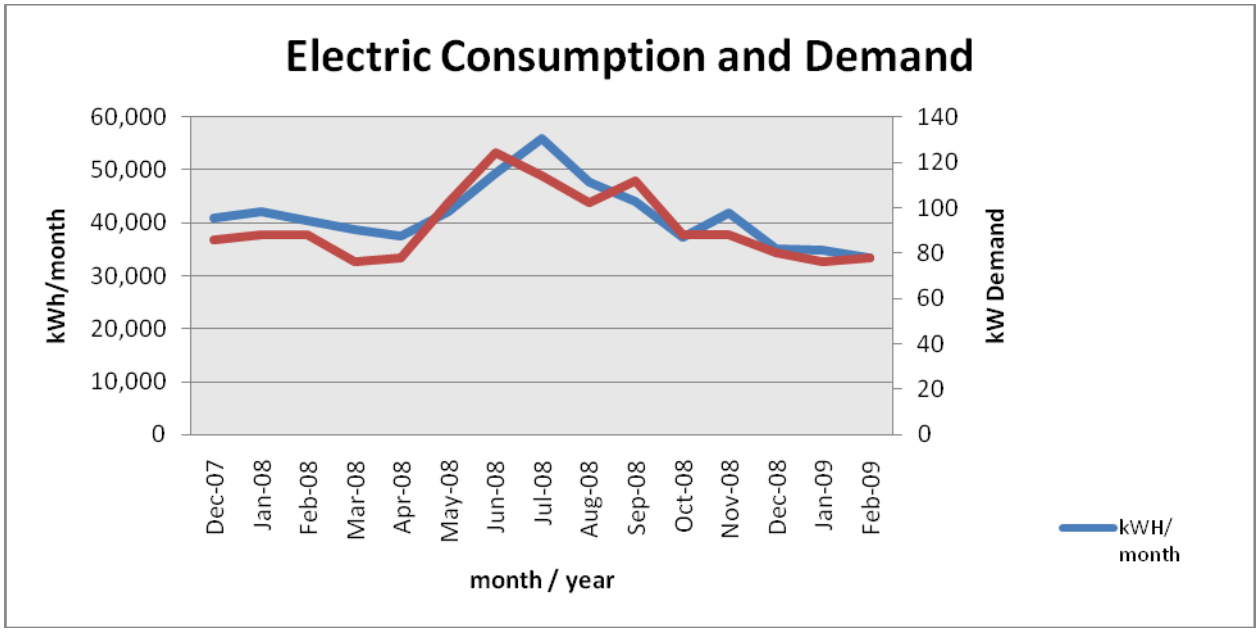
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

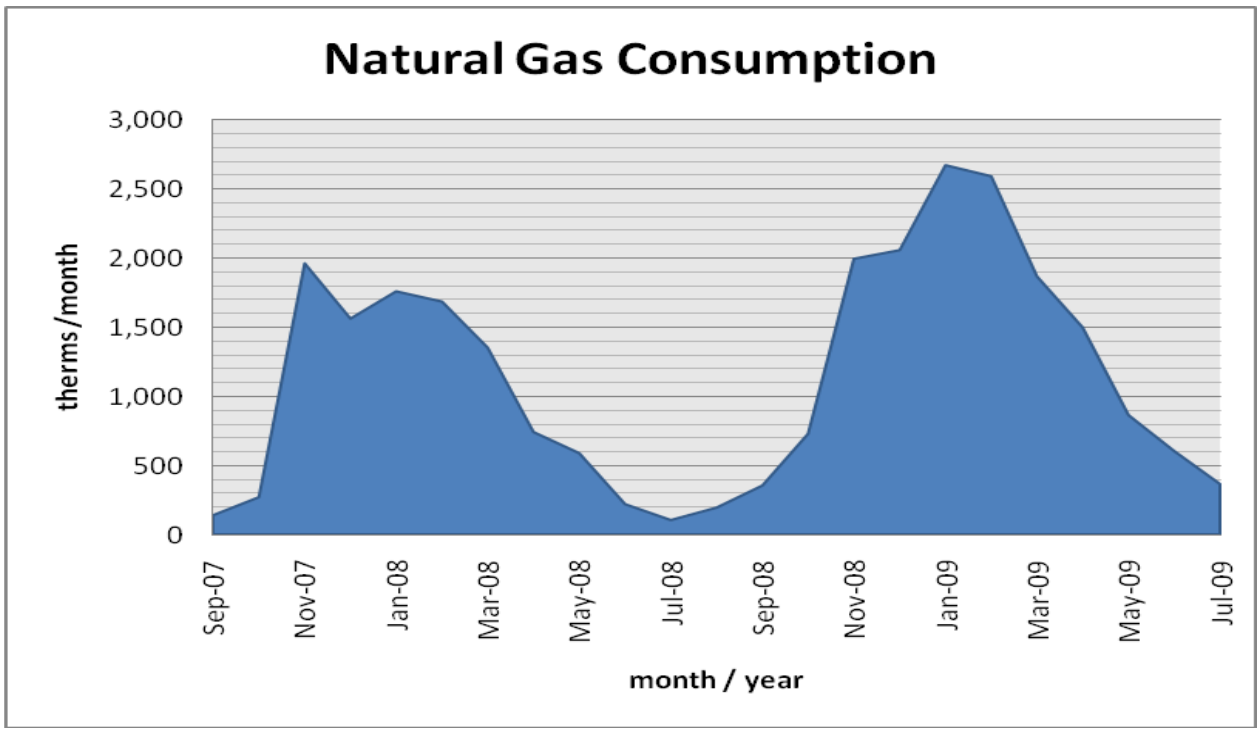
The following are charts that show the annual electric and natural gas load profiles for the Municipal Building.

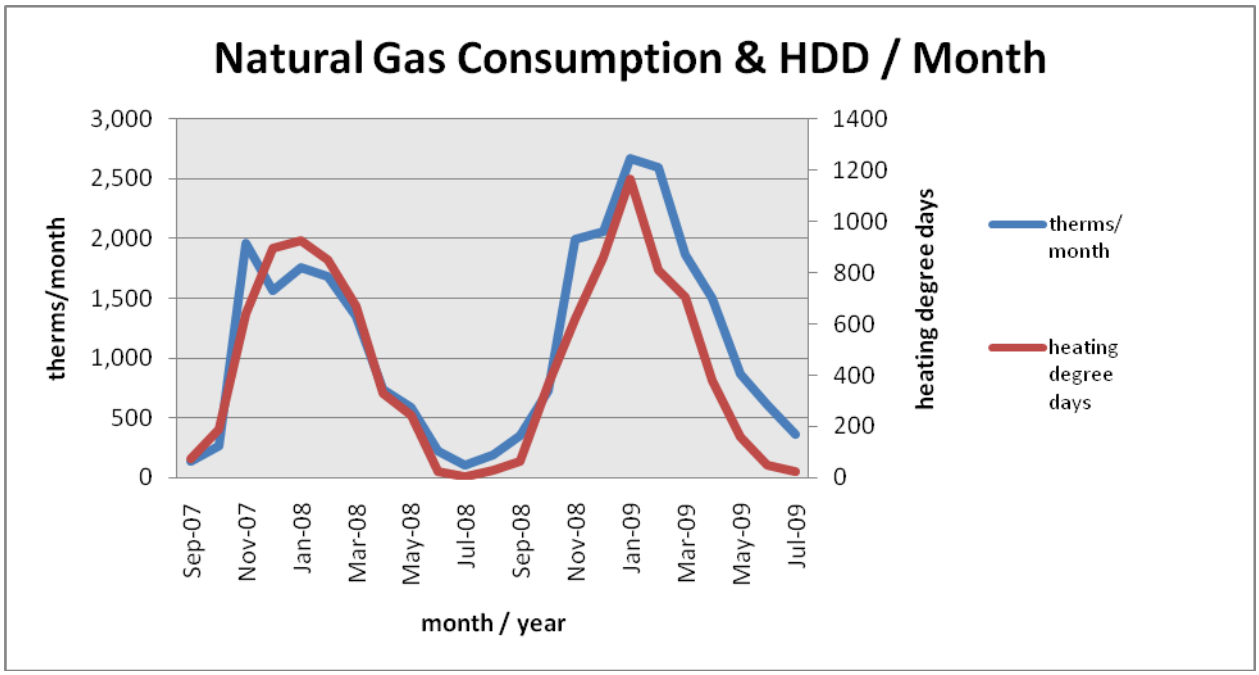


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing gas consumption mimicking the “heating degree days” curve.

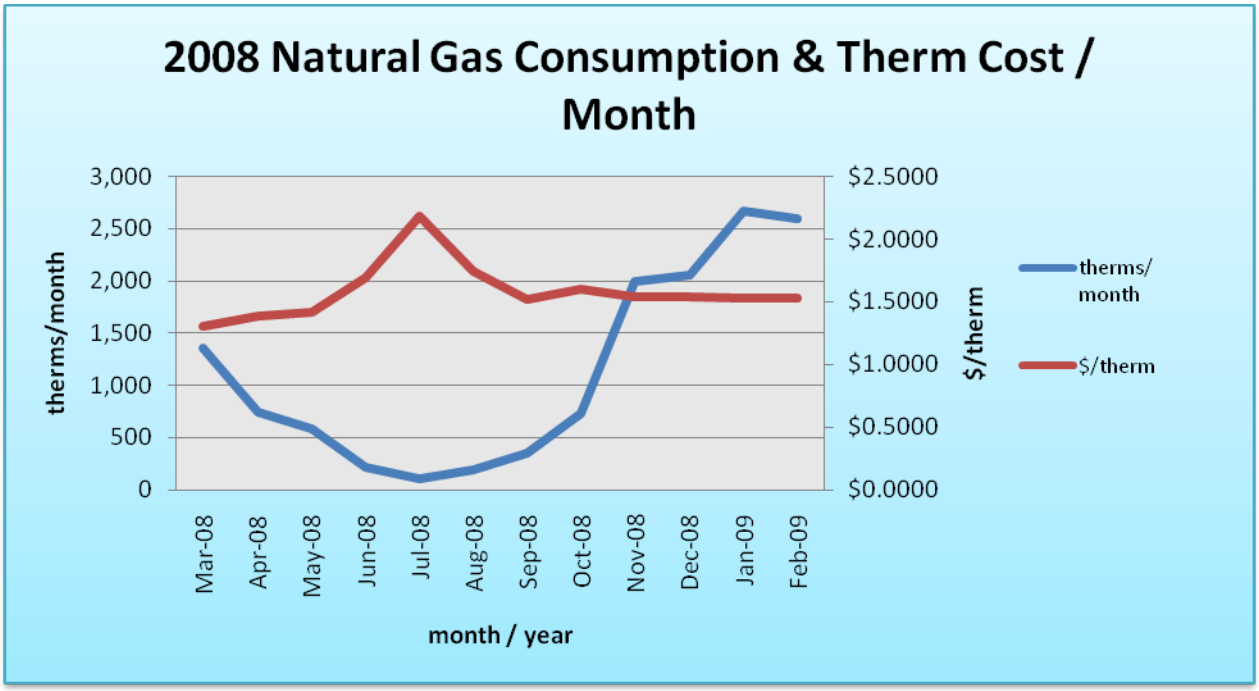




6.2. Tariff analysis

Currently, natural gas is provided to the Municipal building via one gas meter with Elizabethtown Gas Co. acting as the supply and transport company. Gas is provided by Elizabethtown Gas Co. at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Municipal Building billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot

water boiler units. The high gas price per therm fluctuations shown on the following chart may be due to high energy costs that occurred in 2008 and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

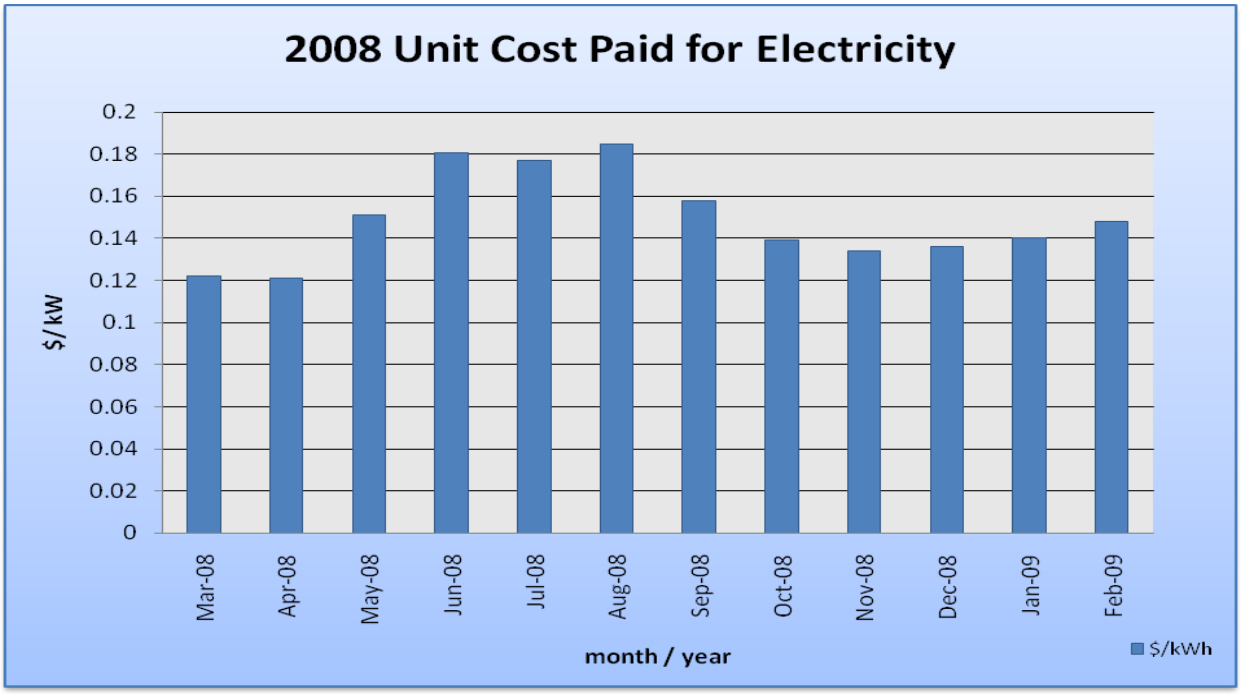


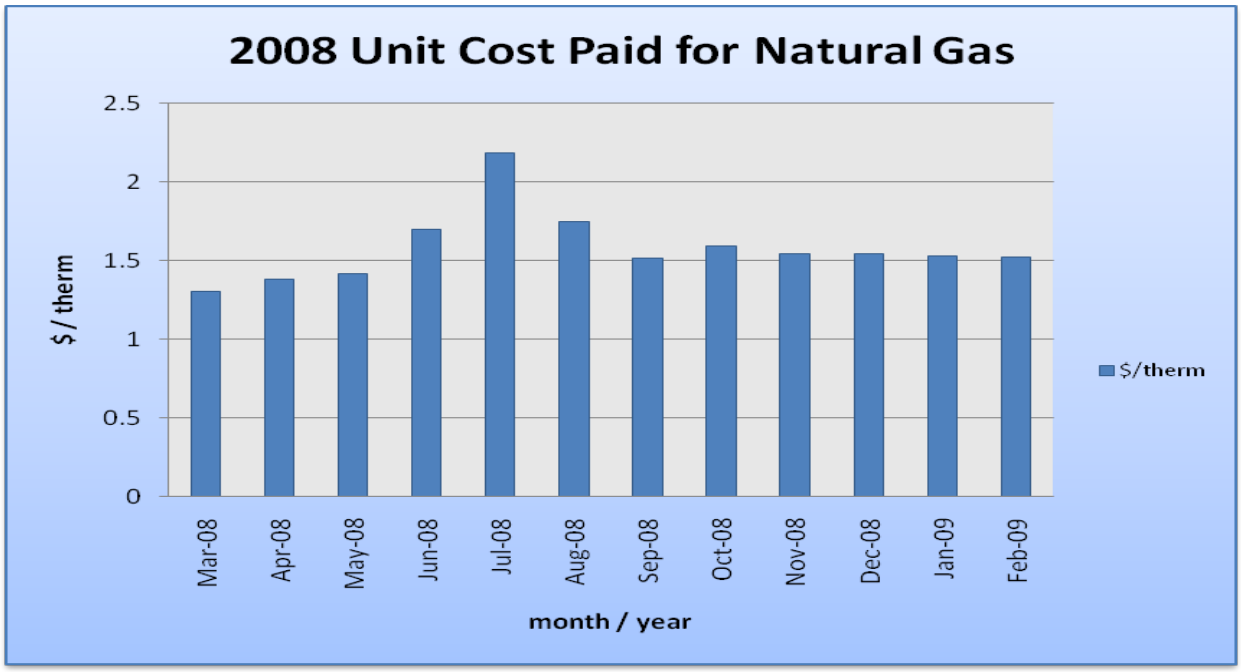
The Municipal Building is direct-metered (via one main meter) and currently purchases electricity from PSE&G at a general service rate. The general service rate for electric charges are market-rate based on use and the Municipal Building billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the rooftop air-handling units.

6.3. Energy Procurement strategies

The Municipal Building receives natural gas via one incoming meter. Elizabethtown Gas Co. supplies the gas and transports it. There is not and ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the Municipal Building from PSE&G without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 34% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 68% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. SWA recommends that the Township of Hopewell further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Municipal Building. Appendix B contains a complete list of third party energy suppliers for the Hopewell service area. The Township of Hopewell may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity

is happening in many parts of the country and in New Jersey. Also, the Municipal Building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 100 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. This adjustment could be achieved by rewiring the 125 kVA generator connections to the building and negotiating reimbursements with the utility company. The following charts show the Municipal Building monthly spending per unit of energy in 2008.





7. METHOD OF ANALYSIS

7.1. 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

7.2. 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.

Appendix A: Lighting Study

Municipal Building Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
1	MB	PD	Hallway	-	T8 U	E	2	2	F	32	24	3072	S	no	T8 U	E	2	2	F	32	24	3072	S	128	
2	MB	PD	Hallway	-	T8 4'	E	1	6	F	32	24	4608	S	no	T8 4'	E	1	6	F	32	24	4608	S	192	
3	MB	PD	Storage Rm	-	T12 4'	M	1	2	F	34	2	136	S	no	**T8 4'**	**E**	**1**	**2**	**F**	**32**	**2**	**102**	**S**	64	
4	MB	PD	Records Discovery	-	T8 4'	E	6	4	F	32	8	6144	S	Yes	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**8**	**6144**	**S**	**768**	**1,536**
5	MB	PD	PDE Lobby	-	T8 4'	E	2	2	F	32	24	3072	S	no	T8 4'	E	2	2	F	32	24	3072	S	128	
6	MB	PD	PDE Lobby	-	LED Exit	NA	1	1	LED	5	24	120	None	no	Exit LED	-	1	1	LED	5	24	120	None	5	
7	MB	PD	PDR Dispatch	-	T8 4'	E	2	4	F	32	24	6144	S	no	T8 4'	E	2	4	F	32	24	6144	S	256	
8	MB	PD	PDR Dispatch	-	Incand	NA	1	4	I	50	12	2400	S	no	**CFL**	**-**	**1**	**4**	**CFL**	**15**	**12**	**720**	**S**	**60**	
9	MB	PD	Operation Lieutnant	-	T8 4'	E	1	2	F	32	10	640	S	no	**T8 4'**	**E**	**1**	**2**	**F**	**32**	**10**	**640**	**S**	64	160
10	MB	PD	Bathroom Women	-	T8 4'	E	2	2	F	32	8	1024	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**8**	**1024**	**S**	**128**	256
11	MB	PD	Bathroom Women	-	T8 2'	E	1	2	F	16	8	256	S	no	**T8 2'**	**E**	**1**	**2**	**F**	**16**	8	256	**S**	32	64
12	MB	PD	Bathroom Men	-	T8 2'	E	1	2	F	16	8	256	S	no	**T8 2'**	**E**	**1**	**2**	**F**	**16**	8	256	**S**	32	64
13	MB	PD	Bathroom Men	-	T8 4'	E	2	2	F	32	8	1024	S	no	**T8 4'**	**E**	**2**	**2**	**F**	32	8	**1024**	**S**	**128**	256
14	MB	PD	Janitor's Closet	-	Incand	-	1	1	I	100	2	200	S	no	**CFL**	**-**	**1**	**1**	**CFL**	**30**	**2**	60	**S**	**30**	
15	MB	PD	Chief	-	T8 4'	E	2	2	F	32	8	1024	S	Yes	**T8 4'**	**E**	**2**	**2**	**F**	**32**	8	**1024**	**S**	**128**	256
16	MB	PD	Squad Room	-	T8 4'	E	6	3	F	32	24	13824	S	no	T8 4'	E	6	3	F	32	24	13824	S	576	
17	MB	PD	Evidence Room	-	T12 4'	M	2	4	F	34	2	544	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**2**	**408**	**S**	**256**	
18	MB	PD	Armory Room	-	T12 4'	M	1	4	F	34	2	272	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**2**	**204**	**S**	**128**	
19	MB	PD	Hallway 2nd	-	LED Exit	NA	6	1	LED	5	24	720	None	no	Exit LED	-	6	1	LED	5	24	720	None	30	
20	MB	PD	Hallway 2nd	-	T8 U	E	10	2	F	32	24	15360	S	no	T8 U	E	10	2	F	32	24	15360	S	640	
21	MB	PD	Detective Office	-	T8 4'	E	4	4	F	32	24	12288	S	no	T8 4'	E	4	4	F	32	24	12288	S	512	
22	MB	PD	Conference Rm	-	T8 4'	E	2	3	F	32	2	384	S	no	T8 4'	E	2	3	F	32	2	384	S	192	
23	MB	PD	Office Lieutenant	-	CFL 15W	E	1	2	CFL	15	8	240	S	no	**CFL 15W**	**-**	**1**	**2**	**CFL**	**15**	**8**	**240**	**S**	**30**	**60**
24	MB	PD	Cell Lobby	-	T12 4'	M	2	2	F	34	24	3264	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**24**	**2448**	**S**	**128**	
25	MB	PD	Cell 1	-	T12 4'	M	2	2	F	34	2	272	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**2**	**204**	**S**	**128**	
26	MB	PD	Cell 2	-	T12 4'	M	2	2	F	34	2	272	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**2**	**204**	**S**	**128**	
27	MB	PD	Cell 3	-	T12 4'	M	2	2	F	34	2	272	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**2**	**204**	**S**	**128**	
28	MB	PD	Cell Shower	-	Incand	NA	1	1	I	60	2	120	S	no	**CFL**	**-**	**1**	**1**	**CFL**	**15**	**2**	30	**S**	**15**	
29	MB	PD	Sally Port	-	T12 4'	M	6	2	F	34	24	9792	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**24**	**7344**	**S**	**384**	**1,836**
30	MB	PD	Office Procesing	-	T8 4'	E	4	3	F	32	24	9216	S	no	T8 4'	E	4	3	F	32	24	9216	S	384	
31	MB	PD	Office Procesing	-	T8 4'	E	4	3	F	32	24	9216	S	no	T8 4'	E	4	3	F	32	24	9216	S	384	
32	MB	PD	Office Procesing	-	Incand	NA	2	1	I	50	2	200	Dim-mer	no	**CFL**	**-**	**2**	**1**	**CFL**	**15**	**2**	60	**Dim- mer**	**30**	
33	MB	PD	Staircase	-	T8 4'	E	2	2	F	32	24	3072	S	no	T8 4'	E	2	2	F	32	24	3072	S	128	
34	MB	PD	Staircase	-	LED Exit	NA	1	1	LED	5	24	120	None	no	Exit LED	-	1	1	LED	5	24	120	None	5	
35	MB	PD	Training Rm	-	T8 4'	E	6	3	F	32	24	13824	S	no	**T8 4'**	**E**	**6**	**3**	**F**	**32**	**24**	**13824**	**S**	**576**	**3,456**
36	MB	PD	Locker Men	-	T12 4'	M	9	2	F	34	24	14688	S	no	**T8 4'**	**E**	**9**	**2**	**F**	**32**	**24**	**11016**	**S**	**576**	**2,754**
37	MB	PD	Locker Women	-	T12 4'	M	9	2	F	34	24	14688	S	no	**T8 4'**	**E**	**9**	**2**	**F**	**32**	**24**	**11016**	**S**	**576**	**2,754**
38	MB	PD	Bathroom Men	-	T8 4'	E	3	2	F	32	24	4608	S	no	**T8 4'**	**E**	**3**	**2**	**F**	**32**	**24**	**4608**	**S**	**192**	**1,152**
39	MB	PD	Bathroom Women	-	T8 4'	E	3	2	F	32	24	4608	S	no	**T8 4'**	**E**	**3**	**2**	**F**	**32**	**24**	**4608**	**S**	**192**	**1,152**
40	MB	PD	Showers Men	-	Incand	NA	1	1	I	60	1	60	S	no	**CFL**	**-**	**1**	**1**	**CFL**	**15**	**1**	**15**	**S**	**15**	
41	MB	PD	Showers Women	-	Incand	NA	1	1	I	60	1	60	S	no	**CFL**	**-**	**1**	**1**	**CFL**	**15**	**1**	**15**	**S**	**15**	
42	MB	PD	TrafficRoom Sargent Office	-	T8 U	E	3	2	F	32	4	768	S	no	T8 U	E	3	2	F	32	4	768	S	192	
43	MB	CA	Staircase	-	T8 4'	E	3	2	F	32	24	4608	S	no	T8 4'	E	3	2	F	32	24	4608	S	192	
44	MB	CA	Staircase	-	LED Exit	NA	1	1	LED	5	24	120	None	no	Exit LED	-	1	1	LED	5	24	120	None	5	
45	MB	CA	Office Area	-	T8 4'	E	12	4	F	32	8	12288	S	no	**T8 4'**	**E**	**12**	**4**	**F**	**32**	**8**	**12288**	**S**	**1536**	**3,072**
46	MB	CA	Office Area	-	T8 U	E	1	2	F	32	8	512	S	no	**T8 U**	**E**	**1**	**2**	**F**	**32**	**8**	**512**	**S**	**64**	**128**
47	MB	CA	Recorts	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
48	MB	CA	Judges Chambers	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
49	MB	CA	Bathroom	-	T8 U	E	1	2	F	32	2	128	S	no	T8 U	E	1	2	F	32	2	128	S	64	
50	MB	CA	Court hallway	-	T8 U	E	1	2	F	32	8	512	S	no	T8 U	E	1	2	F	32	8	512	S	64	
51	MB	CA	Court hallway	-	LED Exit	E	1	2	LED	1	24	48	None	no	Exit LED	-	1	2	LED	1	24	48	None	2	
52	MB	CA	Court Room	-	CFL 13W	E	6	2	CFL	13	24	3744	S	no	**CFL 13W**	**-**	**6**	**2**	**CFL**	**13**	**24**	**3744**	**S**	**156**	**936**
53	MB	CA	Court Room	-	LED Exit	NA	4	1	LED	1	24	96	None	no	Exit LED	-	4	1	LED	1	24	96	None	4	
54	MB	CA	Court Room	-	CFL 23W	E	19	1	CFL	23	1	437	S	no	CFL 23W	-	19	1	CFL	23	1	437	S	437	
55	MB	CA	Court Room	-	CFL 23W	E	7	1	CFL	23	1	161	S	no	CFL 23W	-	7	1	CFL	23	1	161	S	161	
56	MB	CA	Court Room	-	Incand	NA	5	1	I	60	1	300	S	no	**CFL**	**-**	**5**	**1**	**CFL**	**15**	**1**	**75**	**S**	**75**	
57	MB	Grd	Auditorium	-	T8 4'	E	16	4	F	32	4	8192	S	no	T8 4'	E	16	4	F	32	4	8192	S	2048	

Municipal Building Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
58	MB	Grd	Auditorium	-	LED Exit	NA	3	1	LED	1	24	72	None	no	**Exit LED**	**-**	**3**	**1**	**LED**	**1**	**24**	**72**	**None**	**3**	**18**
59	MB	Grd	Storage Rm	-	T8 4'	E	2	4	F	32	4	1024	S	no	T8 4'	E	2	4	F	32	4	1024	S	256	
60	MB	TA	Hallway	-	T8 U	E	11	2	F	32	8	5632	S	no	T8 U	E	11	2	F	32	8	5632	S	704	
61	MB	TA	Hallway	-	LED Exit	NA	3	1	LED	1	24	72	None	no	Exit LED	-	3	1	LED	1	24	72	None	3	
62	MB	TA	Hallway	-	T8 U	E	2	2	F	32	8	1024	S	no	T8 U	E	2	2	F	32	8	1024	S	128	
63	MB	TA	Employees Rm	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
64	MB	TA	Senior Services	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
65	MB	TA	Office Rec	-	T8 4'	E	4	2	F	32	8	2048	S	no	**T8 4'**	**E**	**4**	**2**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
66	MB	TA	Office Admin	-	T8 4'	E	6	4	F	32	8	6144	S	Yes	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**8**	**6144**	**S**	**768**	**1,536**
67	MB	TA	Office Administrator	-	T8 4'	E	6	3	F	32	8	4608	S	no	**T8 4'**	**E**	**6**	**3**	**F**	**32**	**8**	**4608**	**S**	**576**	**1,152**
68	MB	TA	Copy Rm	-	T8 4'	E	2	3	F	32	8	1536	S	no	**T8 4'**	**E**	**2**	**3**	**F**	**32**	**8**	**1536**	**S**	**192**	**384**
69	MB	TA	Clerk's Assistent	-	T8 4'	E	4	3	F	32	8	3072	S	no	**T8 4'**	**E**	**4**	**3**	**F**	**32**	**8**	**3072**	**S**	**384**	**768**
70	MB	TA	Clerk's Office	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
71	MB	TA	Finance	-	T8 4'	E	6	2	F	32	8	3072	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**8**	**3072**	**S**	**384**	**768**
72	MB	TA	Finance Office	-	T8 4'	E	2	4	F	32	8	2048	S	Yes	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
73	MB	TA	Office Tax	-	T8 4'	E	4	3	F	32	8	3072	S	Yes	**T8 4'**	**E**	**4**	**3**	**F**	**32**	**8**	**3072**	**S**	**384**	**768**
74	MB	TA	Office Tax	-	T8 U	E	2	4	F	32	8	2048	S	no	**T8 U**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
75	MB	TA	Records Storage	-	T8 4'	M	6	3	F	32	2	1152	S	no	T8 4'	M	6	3	F	32	2	1152	S	576	
76	MB	LL	Staircase	-	T8 4'	E	3	2	F	32	24	4608	S	no	T8 4'	E	3	2	F	32	24	4608	S	192	
77	MB	LL	Staircase	-	LED Exit	NA	1	1	LED	1	24	24	None	no	Exit LED	-	1	1	LED	1	24	24	None	1	
78	MB	LL	Hallway	-	LED Exit	NA	6	1	LED	1	24	144	None	no	Exit LED	-	6	1	LED	1	24	144	None	6	
79	MB	LL	Hallway	-	T8 U	E	36	2	F	32	4	9216	S	no	T8 U	E	36	2	F	32	4	9216	S	2304	
80	MB	LL	Hallway	-	Incand	NA	3	1	I	100	8	2400	S	no	**CFL**	**-**	**3**	**1**	**CFL**	**30**	**8**	**720**	**S**	**90**	
81	MB	LL	Planning	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
82	MB	LL	Copy Rm	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
83	MB	LL	Office Permits	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
84	MB	LL	Office Construction	-	T12 4'	M	6	4	F	34	8	6528	S	no	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**8**	**4896**	**S**	**768**	**1,224**
85	MB	LL	Office Construction	-	T8 4'	E	1	4	F	32	8	1024	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**8**	**1024**	**S**	**128**	**256**
86	MB	LL	Office Construction 2	-	T8 4'	E	4	4	F	32	8	4096	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**8**	**4096**	**S**	**512**	**1,024**
87	MB	LL	Purchasing	-	T8 4'	E	3	3	F	32	8	2304	S	no	**T8 4'**	**E**	**3**	**3**	**F**	**32**	**8**	**2304**	**S**	**288**	**576**
88	MB	LL	Office Area	-	T8 4'	E	4	4	F	32	8	4096	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**8**	**4096**	**S**	**512**	**1,024**
89	MB	LL	Mechanical Rm	-	T8 4'	E	1	2	F	32	2	128	S	no	T8 4'	E	1	2	F	32	2	128	S	64	
90	MB	LL	Bathroom Men	-	T8 4'	E	2	2	F	32	8	1024	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**8**	**1024**	**S**	**128**	**256**
91	MB	LL	Bathroom Men	-	T8 U	E	1	2	F	32	8	512	S	no	**T8 U**	**E**	**1**	**2**	**F**	**32**	**8**	**512**	**S**	**64**	**128**
92	MB	LL	Bathroom Women	-	T8 U	E	1	2	F	32	8	512	S	no	**T8 U**	**E**	**1**	**2**	**F**	**32**	**8**	**512**	**S**	**64**	**128**
93	MB	LL	Bathroom Women	-	T8 4'	E	3	2	F	32	8	1536	S	no	**T8 4'**	**E**	**3**	**2**	**F**	**32**	**8**	**1536**	**S**	**192**	**384**
94	MB	LL	Janitor's Closet	-	T8 4'	E	1	2	F	32	1	64	S	no	T8 4'	E	1	2	F	32	1	64	S	64	
95	MB	LL	Office Land Use	-	T8 4'	E	2	2	F	32	8	1024	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**8**	**1024**	**S**	**128**	**256**
96	MB	LL	Office Zoning	-	T8 4'	E	4	3	F	32	8	3072	S	no	**T8 4'**	**E**	**4**	**3**	**F**	**32**	**8**	**3072**	**S**	**384**	**768**
97	MB	LL	Lunch Rm	-	T8 4'	E	6	4	F	32	2	1536	S	no	T8 4'	E	6	4	F	32	2	1536	S	768	
98	MB	LL	Municipal Housing	-	T8 4'	E	4	3	F	32	8	3072	S	no	**T8 4'**	**E**	**4**	**3**	**F**	**32**	**8**	**3072**	**S**	**384**	**768**
99	MB	LL	Sanitation	-	T8 4'	E	6	4	F	32	8	6144	S	no	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**8**	**6144**	**S**	**768**	**1,536**
100	MB	LL	Health Official	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
101	MB	LL	Health Admin	-	T8 4'	E	2	2	F	32	8	1024	S	no	**T8 4'**	**E**	**2**	**2**	**F**	**32**	**8**	**1024**	**S**	**128**	**256**
102	MB	LL	Health Admin	-	T8 4'	E	2	1	F	32	8	512	S	no	**T8 4'**	**E**	**2**	**1**	**F**	**32**	**8**	**512**	**S**	**64**	**128**
103	MB	LL	Health Admin	-	T8 4'	E	1	4	F	32	8	1024	S	no	**T8 4'**	**E**	**1**	**4**	**F**	**32**	**8**	**1024**	**S**	**128**	**256**
104	MB	LL	Animal Control	-	T8 4'	E	4	4	F	32	8	4096	S	no	**T8 4'**	**E**	**4**	**4**	**F**	**32**	**8**	**4096**	**S**	**512**	**1,024**
105	MB	LL	Public Health Nurse	-	T8 4'	E	6	4	F	32	8	6144	S	no	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**8**	**6144**	**S**	**768**	**1,536**
106	MB	LLA	Hallway 1	-	T8 4'	E	12	2	F	32	4	3072	S	no	T8 4'	E	12	2	F	32	4	3072	S	768	
107	MB	LLA	Hallway 1	-	LED Exit	NA	2	1	LED	1	24	48	None	no	Exit LED	-	2	1	LED	1	24	48	None	2	
108	MB	LLA	Boiler Rm	-	T12 4'	M	6	2	F	34	4	1632	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**4**	**1224**	**S**	**384**	
109	MB	LLA	Generator Room	-	T8 4'	E	4	2	F	32	1	256	S	no	T8 4'	E	4	2	F	32	1	256	S	256	
110	MB	LLA	Eletrical Rm	-	T12 4'	M	6	2	F	34	1	408	S	no	**T8 4'**	**E**	**6**	**2**	**F**	**32**	**1**	**306**	**S**	**384**	
111	MB	LLA	PBA Exercise Room	-	T8 4'	E	2	2	F	32	2	256	S	no	T8 4'	E	2	2	F	32	2	256	S	128	
112	MB	LLA	Computer Storage	-	T8 4'	E	2	4	F	32	1	256	S	no	T8 4'	E	2	4	F	32	1	256	S	256	

Municipal Building Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
113	MB	LLA	Construction Archive	-	T8 4'	E	8	4	F	32	1	1024	S	no	T8 4'	E	8	4	F	32	1	1024	S	1024	
114	MB	LLA	Utility Rm	-	T8 4'	E	1	2	F	32	1	64	S	no	T8 4'	E	1	2	F	32	1	64	S	64	
115	MB	LLA	Evidence Storage 1	-	T8 4'	E	2	3	F	32	2	384	S	no	T8 4'	E	2	3	F	32	2	384	S	192	
116	MB	LLA	Evidence Storage 1	-	T8 4'	E	2	3	F	32	2	384	S	no	T8 4'	E	2	3	F	32	2	384	S	192	
117	MB	LLA	Hallway	-	T8 4'	E	2	4	F	32	12	3072	S	no	T8 4'	E	2	4	F	32	12	3072	S	256	
118	MB	LLA	Hallway	-	LED Exit	NA	7	4	LED	1	12	336	None	no	Exit LED	-	7	4	LED	1	12	336	None	28	
119	MB	LLA	Hallway	-	T8 2'	E	2	2	F	16	12	768	S	no	T8 2'	E	2	2	F	16	12	768	S	64	
120	MB	LLA	Office Fire Chief	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
121	MB	LLA	Office Fire Captain	-	T8 4'	E	2	4	F	32	8	2048	S	no	**T8 4'**	**E**	**2**	**4**	**F**	**32**	**8**	**2048**	**S**	**256**	**512**
122	MB	LLA	Staircase	-	T8 4'	E	3	2	F	32	24	4608	S	no	T8 4'	E	3	2	F	32	24	4608	S	192	
123	MB	LLA	Staircase	-	LED Exit	NA	1	1	LED	1	24	24	None	no	Exit LED	-	1	1	LED	1	24	24	None	1	
124	MB	Grd	Main Lobby	-	LED Exit	NA	4	1	LED	1	8	32	None	no	Exit LED	-	4	1	LED	1	8	32	None	4	
125	MB	Grd	Main Lobby	-	T8 U	E	25	2	F	32	8	12800	S	no	T8 U	E	25	2	F	32	8	12800	S	1600	
126	MB	Grd	Main Lobby	-	T12 8'	M	4	2	F	68	8	4352	S	no	**T8 4'**	**E**	**8**	**2**	**F**	**32**	**8**	**3264**	**S**	**512**	
127	MB	Grd	Main Lobby	-	Incand	NA	1	2	I	60	8	960	S	no	**CFL**	**-**	**1**	**2**	**CFL**	**15**	**8**	**240**	**S**	**30**	
128	MB	Grd	Main Lobby	-	CFL 23W	E	1	6	CFL	23	8	1104	S	no	CFL 23W	-	1	6	CFL	23	8	1104	S	138	
129	MB	Grd	Main Lobby	-	Halogen	NA	4	1	H	50	8	1600	S	no	Halogen	NA	4	1	H	50	8	1600	S	200	
130	MB	Grd	Main Lobby	-	Incand	NA	7	1	I	60	8	3360	S	no	**CFL**	**-**	**7**	**1**	**CFL**	**15**	**8**	**840**	**S**	**105**	
131	MB	Grd	Conference Room	-	T8 4'	E	2	6	F	32	4	1536	S	no	**T8 4'**	**E**	**2**	**6**	**F**	**32**	**4**	**1536**	**S**	**384**	**384**
132	MB	ext	Exterior Wall packs	-	High Press Sodium	NA	15	1	HPS	70	12	12600	Autom Timer	no	High Press Sodium	NA	15	1	HPS	70	12	12600	Autom Timer	1050	
133	MB	ext	Exterior	-	Incand	NA	6	1	I	75	12	5400	Autom Timer	no	**CFL**	**-**	**6**	**1**	**CFL**	**15**	**12**	**1080**	**Autom Timer**	**90**	
134	MB	ext	Exterior	-	Metal Halide	NA	11	1	MH	250	12	33000	Autom Timer	no	Metal Halide	NA	11	1	MH	250	12	33000	Autom Timer	2750	
135	MB	ext	Exterior Pole Lights	-	T12 8'	M	13	2	F	68	12	21216	Autom Timer	no	**T8 4'**	**E**	**26**	**2**	**F**	**32**	**12**	**15912**	**Autom Timer**	**1664**	
136	MB	ext	Exterior	-	CFL 23W	E	4	1	CFL	23	12	1104	Autom Timer	no	CFL 23W	-	4	1	CFL	23	12	1104	Autom Timer	92	
137	MB	ext	Exterior Bollards	-	High Press Sodium	NA	10	1	HPS	100	12	12000	Autom Timer	no	High Press Sodium	NA	10	1	HPS	100	12	12000	Autom Timer	1000	
138	MB	ext	Building Exterior signs	-	T12 10'	M	3	4	F	117	12	16848	Autom Timer	no	**T8 4'**	**E**	**6**	**4**	**F**	**32**	**12**	**12636**	**Autom Timer**	**768**	
				TOTALS exterior								102,168										88,332			
				TOTALS interior								361,370										339,805		45,420	44,366
annual consumption (kWh)												136,666										113,487	includes occupancy sensors		
estimated cost ($/year)												$20,774										$17,250			
Municipal Building total light power (Watt)												48,059										45,420			
Municipal Building light power density (Watt/sq ft)												1.35										1.28			
Proposed Annual Savings (kWh)												23,181													
Proposed Annual Cost Savings ($)												$3,524													
Proposed Investment ($)												$19,400													
surface area (sq ft)												35,501										35,501			
Legend: Municipal Building - MB; M - magnetic; E - electronic; F - fluorescent; incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium; MH - Metal Halide; S - on/off switch; Halogen - H																									
Police Department - PD; Court Area - CA; Lower Level - LL; Lower Level Expansion - LLA; Town Administration - TA; Ground Floor - Grd;																									

Note: Last table column shows additional electrical savings if the decision is to change out switches to occupancy sensors.

Appendix B: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

PSE&G ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 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 Corp.** 300 Madison Avenue Morristown, NJ 07962 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 07960 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-538-3124 www.creditsuisse.com	**Sprague Energy Corp.** 12 Ridge Road Chatham Township NJ 07928 (800) 225-1560 www.spragueenergy.com	

ELIZABETHTOWN GAS COMPANY NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Glacial Energy of New Jersey, Inc.** 207 LaRoche Avenue Harrington Park, NJ 07640 1-877-569-2841 www.glacialenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-53-Metro www.metroenergy.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com