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May 5, 2010

Local Government Energy Program
Energy Audit Report

Township of Parsippany – Troy Hills

Parsippany – Troy Hills Water Utilities Office
1 Pump House Road
Parsippany, NJ 07054

Project Number: LGEA26

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INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Parsippany – Troy Hills buildings. The audit included a review of the Parsippany – Troy Hills Town Hall, Public Library, Community Center and Tennis Club, Police Headquarters, Parks Forestry and Recreation building, as well as the Water Utilities Office, DPW building, Park Road Booster Station building, Well 21 building, and Sewer Pump station # 4 building. The buildings are located in Parsippany and Lake Hiawatha, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Parsippany – Troy Hills Water Utilities Office building located at 1 Pump House Road, Parsippany, NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Parsippany - Troy Hills Water Utilities Office building, located at 1 Pump House Road was opened in 1981. The Parsippany - Troy Hills Water Utilities Office consists of approximately 13,600 square feet of conditioned space with occupancy of approximately. The building is home to offices, a control center for the Parsippany Water Department and garage. The building is not open to the public and access is restricted to authorized personnel. It is open all day every day with no exceptions.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Parsippany – Troy Hills to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 6 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The Parsippany - Troy Hills Water Utilities Office building, located at 1 Pump House Road was opened in 1981. The Parsippany - Troy Hills Water Utilities Office consists of approximately 13,600 square feet of conditioned space with occupancy of approximately 8 employees. The building is home to offices, a control center for the Parsippany Water Department and garage. The building is not open to the public and access is restricted to authorized personnel. It is open all day every day with no exceptions.

Based on the field visit performed by the SWA staff on October 21st, 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.

Existing conditions

From September 2008 through August 2009, the period of analysis for this audit, the building consumed 65,200 kWh or $10,931 worth of electricity at an approximate rate of $0.168/kWh and 6,662 therms or $9,711 worth of natural gas at an approximate rate of $1.458/therm. The joint energy consumption for the building, including both electricity and fossil fuel, was 889 MMBtus of energy that cost a total of $20,642.

SWA has entered energy information about the Water Utilities Office in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating due to its classification and size. SWA encourages the Township of Parsippany - Troy Hills to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 65.3 kBtu/sq ft yr compared to the national average of a building consuming 104 kBtu/sq ft yr. Implementing this report's ECMs will result in a reduction of 8.0 kBtu/sq ft yr from the recommended ECMs and 0.2 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Recommendations

Implementing this report's recommendations will reduce use by approximately 8.2 kBtu/ft^{2}yr, which would decrease the building's energy use intensity to 57.1 kBtu/ft^{2}yr.

The Water Utilities office is approximately 29 years old and has been reasonably well-maintained throughout its lifetime. Much of the Heating, Ventilation and Air-Conditioning (HVAC) equipment has been replaced at some point with the exception of the original Lennox air handler located above the basement office ceiling. SWA recommends a package of measures that addresses lighting, HVAC as well as introduces renewable energies in the form of a Solar Photovoltaic array.

Based on the assessment of the building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Upgrade existing windows
- Upgrade belt drive exhaust fans

Category II Recommendations: Operations and Maintenance

- Program all computers for power save
- Replace fan belt on exhaust fan
- Bi-annual inspections of exterior walls
- Bi-annual inspections of roof surfaces
- Bi-annual inspections of windows/doors
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **1** Energy Conservation Measure (ECM) for the Water Utilities Office that is summarized in the following Table 1. The total investment cost for this ECM with incentives is **$20**. SWA estimates a first year savings of **$21** with a simple payback of **<1.0 year**. SWA also recommends **3** ECMs with a 5-10 year payback that is summarized in Table 2 and **1** End of Life Cycle ECMs summarized in Table 3.

The implementation of all the recommended ECMs would reduce or offset the building electric usage by 32,768 kWh annually, or 50% of the building's current electric consumption. There are no recommended ECMs that reduce natural gas consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Water Utilities Office by **58,671 lbs of CO_2**, which is equivalent to removing approximately 4 cars from the roads each year or avoiding the need of 141 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Parsippany - Troy Hills contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.018/kWh, which would have equated to $1,174 for the past 12 months.

There are various incentives that Township of Parsippany - Troy Hills could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Parsippany - Troy Hills 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 could also assist to cover 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through JCP&L that would allow the building to pay for the installation of the PV system through a loan issued by JCP&L.

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs																			
ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install 2 new CFL lamps	RSMeans	20	0	20	95	0.0	0	0.0	5	21	15	247	1.0	1133.2	75.5	104.7	157	170
	TOTALS		**20**	**0**	**20**	**95**	**0.0**	**0**	**0.0**	**5**	**21**	**-**	**247**	**1.0**	**-**	**-**	**-**	**157**	**170**

Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs																		
ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Install 20kW Solar PV array on Garage roof	Similar Project	140,000	20,000	120,000	23,608	20.0	0	5.9	0	17,766	25	302,582	6.8	152.2	6.1	12.7	109,934	42,270
3	Install 2 new Occupancy Sensors	RSMeans	440	40	400	256	0.1	0	0.1	0	43	15	506	9.3	26.5	1.8	6.7	106	458
4	Install 25 new Pulse Start Metal Halide fixtures	RSMeans	20,131	625	19,506	8,191	1.7	0	2.1	591	1,967	15	23,147	9.9	18.7	1.2	5.7	3,641	14,666
	TOTALS		**160,571**	**0**	**139,906**	**32,055**	**21.8**	**0**	**8.0**	**591**	**19,776**	**-**	**326,235**	**7.1**	**-**	**-**	**-**	**113,681**	**57,394**

Table 3 - Recommended End of Life Cycle ECMs																		
ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5	Replace Lennox air handling units in office ceiling	RSMeans	6,370	279	6,091	618	0	0	0.2	60	164	25	2,790	37.2	-54.2	-2.2	-2.8	-3,301	1,107
	TOTALS		**6,370**	**279**	**6,091**	**618**	**0.0**	**0**	**0.2**	**60**	**164**	**-**	**2,790**	**37.2**	**-**	**-**	**-**	**-3,301**	**1,107**

Note: For more details on End of Life Cycle ECMs and associated incremental cost for high efficiency equipment and performance see Section 4.

1. HISTORIC ENERGY CONSUMPTION

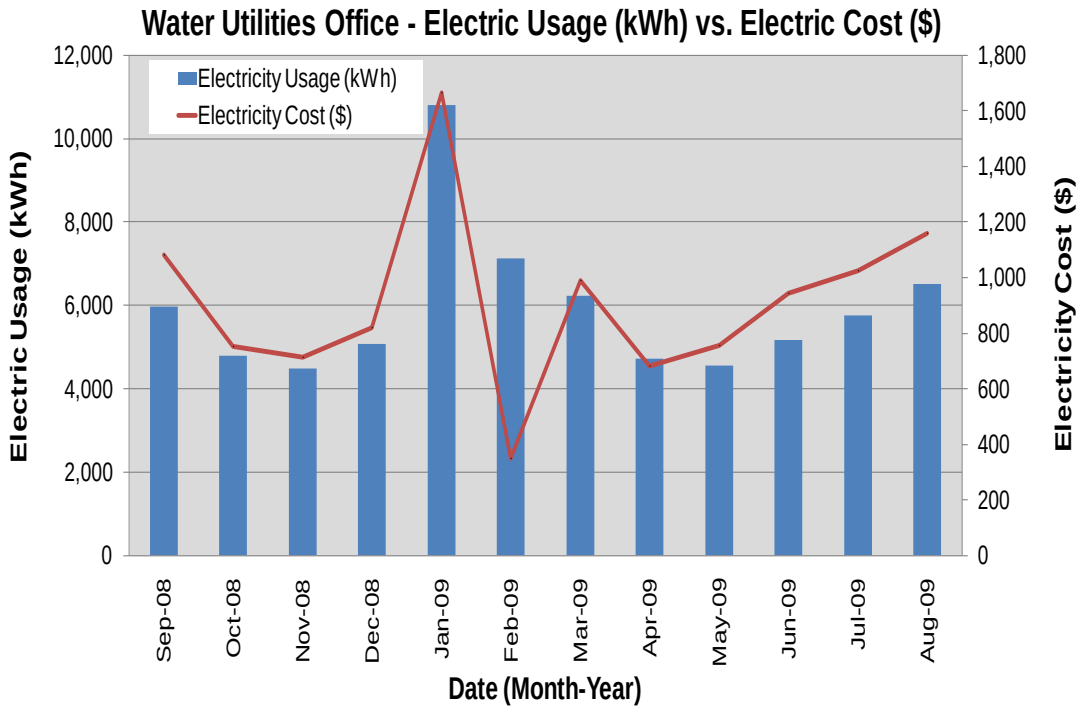
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **September 2008 through August 2009** (period of analysis) that were received from the utility companies supplying the Water Utilities Office with electric and natural gas.

Electricity - The Water Utilities Office buys electricity from JCP&L at **an average rate of $0.168/kWh** based on 12 months of utility bills from September 2008 to August 2009. The Water Utilities Office purchased **approximately 65,200 kWh or $10,931 worth of electricity** in the previous year. The Water Utilities Office is currently charged for demand (kW) which has been factored into each monthly bill. The peak demand for the building is **21.7 kW** and the average monthly demand is **19.3 kW.**

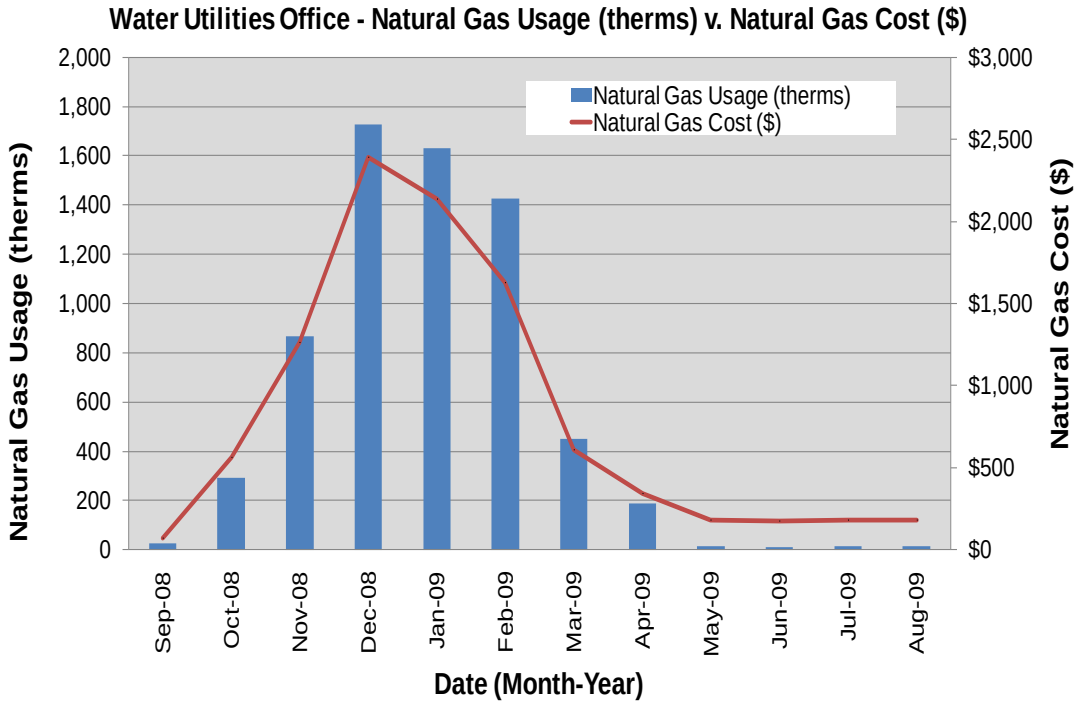
Natural gas - The Water Utilities Office is currently served by one meter for natural gas. The Water Utilities Office currently buys natural gas from New Jersey Natural Gas (NJNG) at **an average aggregated rate of $1.458/therm** based on 12 months of utility bills for September 2008 to August 2009. The Water Utilities Office purchased **approximately 6,662 therms or $9,711 worth of natural gas** in the previous year.

The following chart shows electricity use versus cost for the Water Utilities Office based on utility bills for the 12 month period of September 2008 to August 2009.



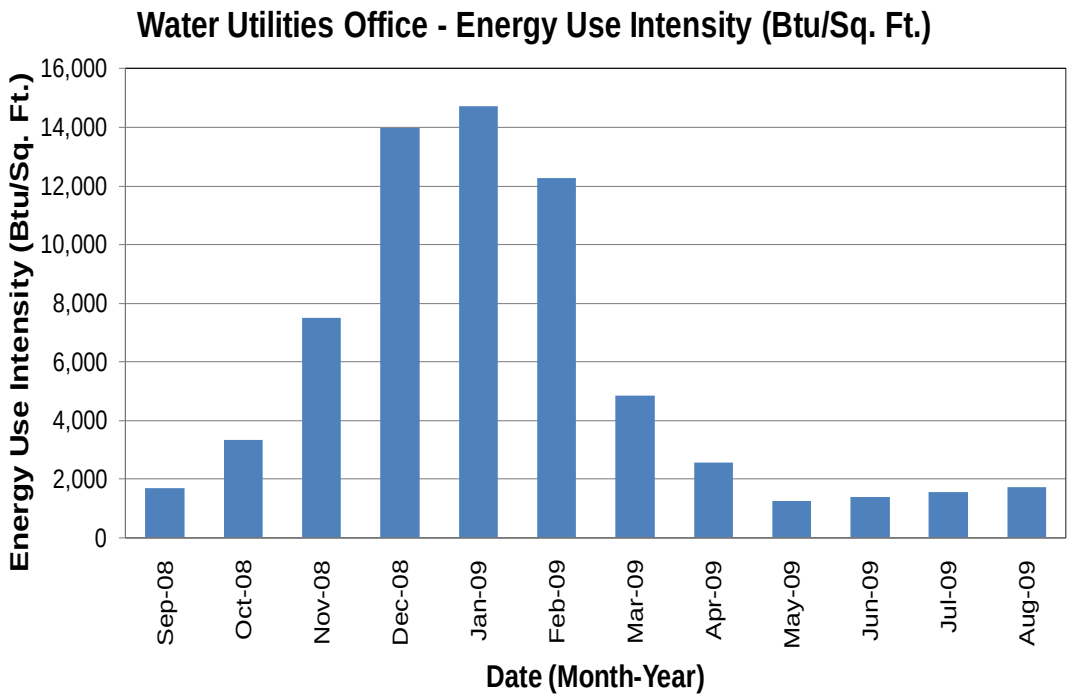
Electricity use follows a trend as expected; peaking during the summer months when air conditioning units are used most, additionally, in the case of the water utilities office there is also a trend of a spike in the winter due to the use of electricity as a heating energy source. The cost of electricity fluctuates as expected with usage.

The following is a chart of the natural gas annual load profile for the building versus natural gas costs, peaking in the coldest months of the year.



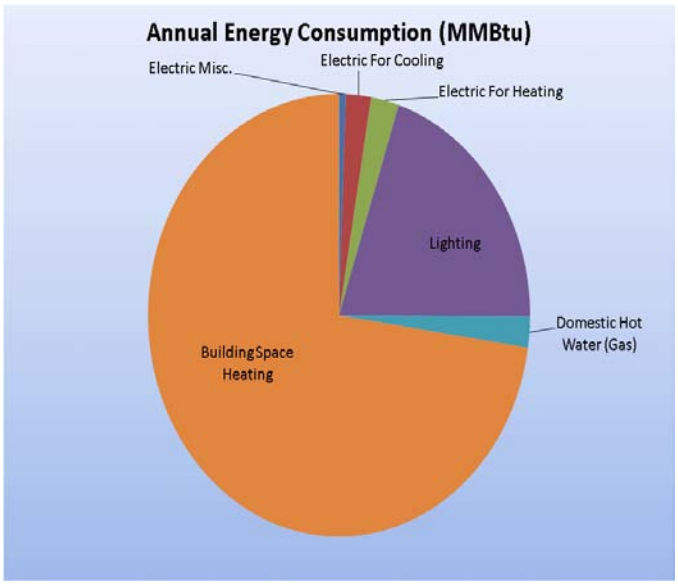
In the above chart, the natural gas use follows a heating trend as expected. During the summer it is clear that the natural gas use is very minimal which reflects that heat is not being used and the domestic hot water (DHW) load is minimal.

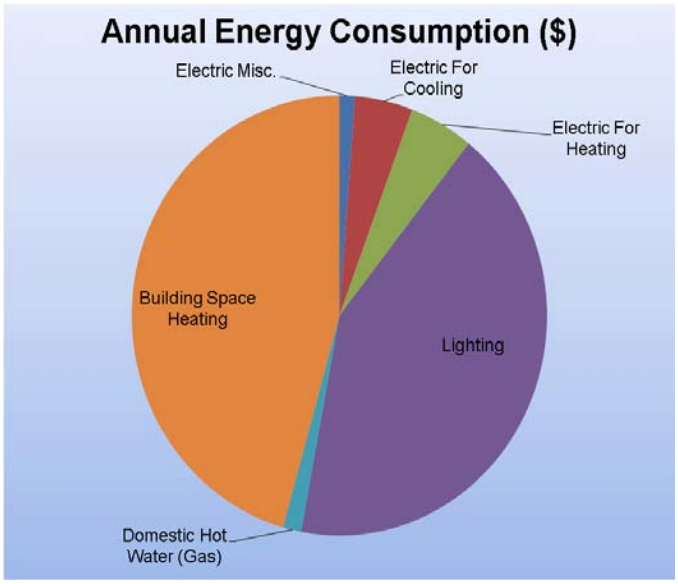
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the building based on utility bills for the 12 month period of September 2008 to August 2009.



The following table and chart pies show energy use for the Water Utilities Office based on utility bills for the 12 month period of September 2008 to August 2009. Note electrical cost at $49/MMBtu of energy is more than 3 times as expensive to use as natural gas at $15/MMBtu.

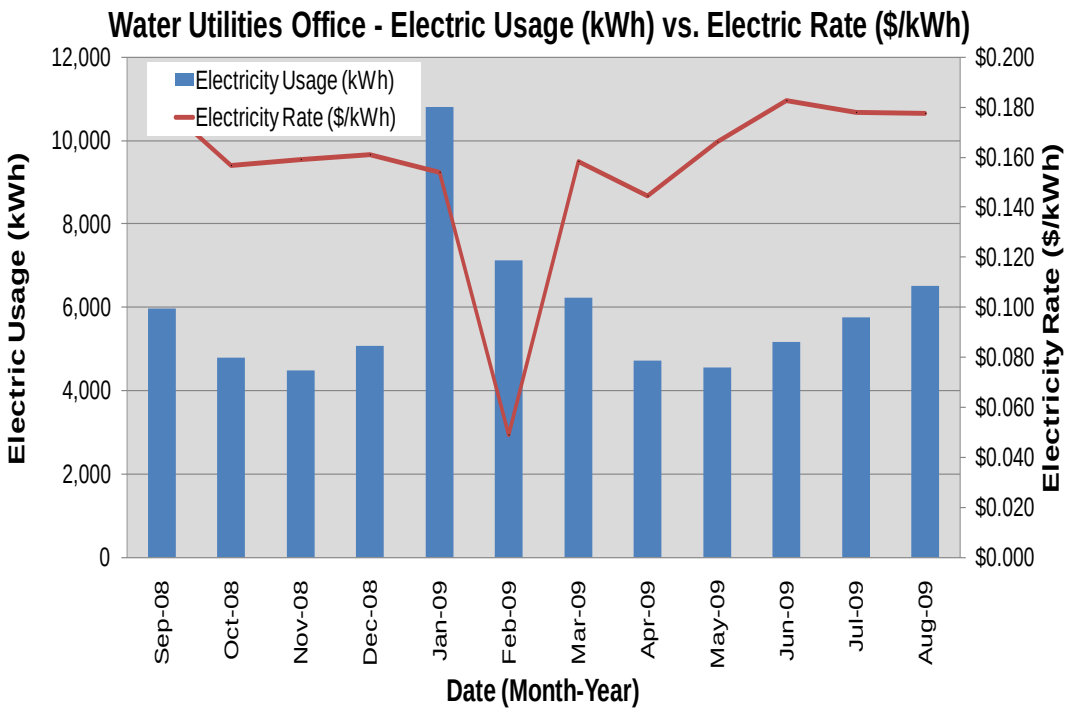
Sept. 2008 - Aug. 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	5	1%	$245	1%	49
Electric For Cooling	19	2%	$931	5%	49
Electric For Heating	21	2%	$1,029	5%	49
Lighting	178	20%	$8,725	42%	49
Domestic Hot Water (Gas)	20	2%	$292	1%	15
Building Space Heating	646	73%	$9,419	46%	15
Totals	889		$20,642	100%	
Total Electric Usage	223	25%	$10,931	53%	49
Total Gas Usage	666	75%	$9,711	47%	15
Totals	889	100%	$20,642	100%	



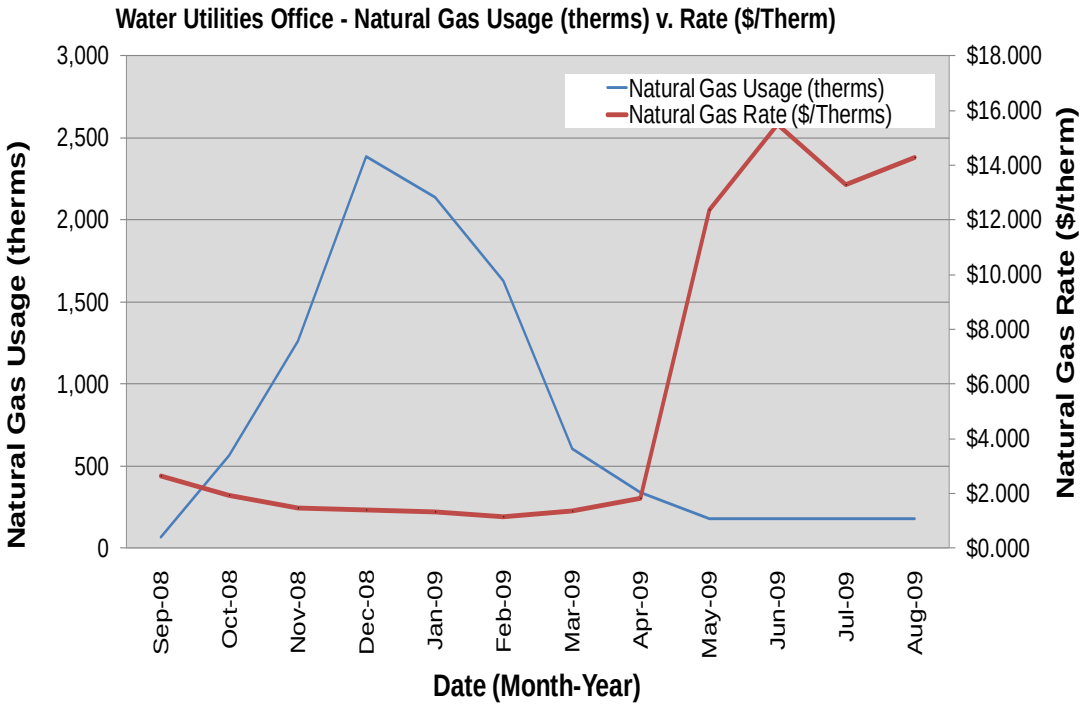


1.2. Utility rate analysis

The Water Utilities Office currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Water Utilities Office currently pays an average rate of approximately $0.168/kWh based on the 12 months of utility bills of September 2008 to August 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time and increase in the winter that corresponds with the use of electricity as a heating fuel source. Based on these observations this appears to be the appropriate rate for the building.



The Water Utilities Office currently purchases natural gas supply from the NJNG at a general service market rate for natural gas (therms). There is one gas meter that provides natural gas service to the Water Utilities Office currently. The average aggregated rate (supply and transport) for the meter is approximately $1.458/therm based on 12 months of utility bills for September 2008 to August 2009. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Water Utilities Office 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 boilers. The high gas price per therm fluctuations in the summer may also be from the building paying for fixed costs such as meter reading charges during the summer months.



1.3. Energy benchmarking

SWA has entered energy information about the Water Utilities Office in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating due to its classification and size. SWA encourages the Township of Parsippany - Troy Hills to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 65.3 kBtu/sq ft yr compared to the national average of a building consuming 104 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 0.2 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Per the LGEA program requirements, SWA has assisted Parsippany-Troy Hills to create an *Energy Star Portfolio Manager* account and has shared the Firehouse building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: ParsippanyTroyHillsTownship
Password: PARSIPPANY

Also, a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool is shown below:

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Water Utility Offices

Building ID: 1970870
For 12-month Period Ending: August 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: December 23, 2009

Facility	Facility Owner	Primary Contact for this Facility
Water Utility Offices 1 Pump House Road Parsippany, NJ 07054	Township of Parsippany - Troy Hills 1001 Parsippany Boulevard Parsippany, NJ 07054	Jasmine L. Lim 1001 Parsippany Boulevard Parsippany, NJ 07054

Year Built: 1981
Gross Floor Area (ft²): 13,600

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	222,462
Natural Gas (kBtu)[4]	666,120
Total Energy (kBtu)	888,582
Energy Intensity[5]	
Site (kBtu/ft²/yr)	65
Source (kBtu/ft²/yr)	106
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	69
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-50%
Building Type	Other

Stamp of Certifying Professional

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

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 Parsippany - Troy Hills Water Utilities Office building, located at 1 Pump House Road was opened in 1981. The Parsippany - Troy Hills Water Utilities Office consists of approximately 13,600 square feet of conditioned space with occupancy of approximately 8 employees. The building is home to offices, a control center for the Parsippany Water Department and garage. It consists of two different flat roof portions, a two floor office and control center wing and single story garage wing. The building is not open to the public and access is restricted to authorized personnel. It is open all day every day with no exceptions.

2.2. Building occupancy profiles

There are approximately 8 full time employees per shift in the Water Utilities Office and occupancy will not increase since the building is not open to the public and access is restricted to authorized personnel. It is open all day every day with no exceptions.

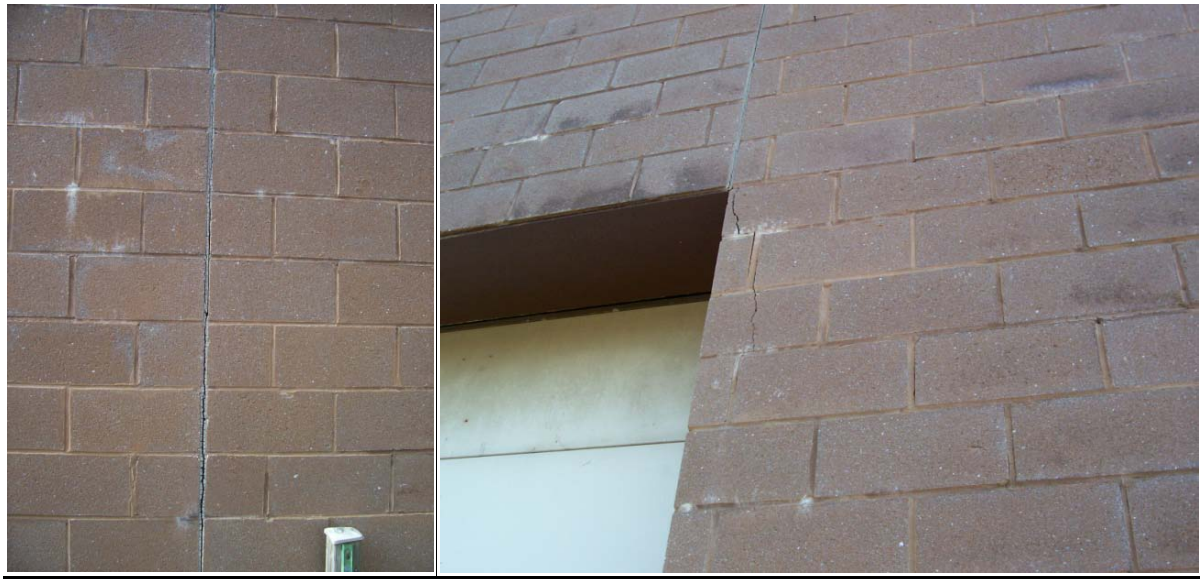
2.3. Building envelope

2.3.1.Exterior Walls

There are two typical types of exterior walls at the Water Utilities Office. At the office and control center portions of the building the exterior wall is constructed of 8" split face concrete block, with a decorative coating on the upper portion of the wall, and drip edge. To its interior is a layer of rigid insulation and gypsum board wall. At the garage portion of the building the exterior wall is constructed of 12" concrete block with masonry reinforcement.

Existing Exterior Walls

Overall, exterior and interior wall finishes of the envelope were found to be in age-appropriate, good condition with no major signs of water or air leakage. There were some isolated instances at surface transitions, building corners, and seams that are beginning to show signs of cracking and other damage as well as some cracked concrete blocks. SWA does however; recommend biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.



Exterior wall cracks at seams and cracked concrete blocks

2.3.2.Roof

The roof of the Water Utilities Office was installed 3 years ago and consists of a gray two level flat roof that is slightly sloped for drainage. The surface of the roof is gray roofing membrane and built up roofing, above layers of rigid insulation, metal decking, and steel joists with their own layer of blanket insulation. The roof is specified to have a thermal resistance U-Factor of 0.08. The roof is in good age appropriate condition. Given the age of the building, there are no improvements to the roof assembly or insulation that would provide a significant improvement to the building performance; however, SWA does recommend biannual maintenance inspections with a focus on the drainage, penetrations, flashing and seams of the roof.

Existing Built-up Roof

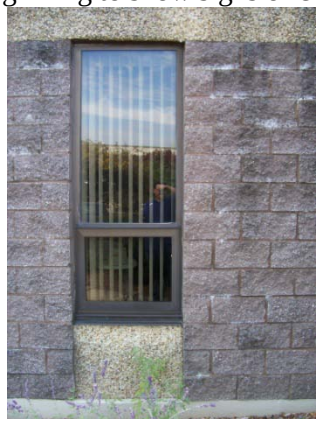
2.3.3. Base

The building's base is 5" concrete slab-on-grade with vapor barrier and porous fill. There were no reported problems with water penetration or moisture. The benefits of installing slab perimeter insulation would not justify the expense and disruption of excavating around the entire building. If excavation is ever required for other reasons, consideration should be given to installing a minimum of 2 inches of rigid foam board insulation.

2.3.4. Windows

The existing windows of the Water Utilities Office are aluminum frame units with a single layer of glazing. They are primarily combinations of fixed casement unit with push out operable casements beneath. Additionally there are transom units above the exterior doors.

Installation of new windows would not be economically viable, but as a best practice, SWA recommends that all windows be inspected at least twice a year. Any gaps, cracks, or damage to weather-stripping or caulking should be repaired or replaced, as needed, to minimize energy loss around those openings. Most of the windows appear to be in good age-appropriate condition; however, some of the units are beginning to show signs of cracking around the frames.



Typical Window installation

2.3.5. Exterior doors

There are three different types of exterior doors at the Water Utilities Office as there aluminum framed glass entrance doors, metal frame insulated hollow core metal exit doors and paneled aluminum overhead garage doors. The exterior doors are in excellent condition and virtually all of the weather-stripping is still intact. If not properly maintained, exterior doors can become major sources of heat loss and infiltration. As a best practice, SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. This will help optimize comfort and energy performance.

2.3.6. Building air tightness

Based on a visual inspection and communication with the building staff, the building was observed to be well-sealed and air tight which is consistent with the age and intended use of the building. As a best practice, weather-stripping on doors and windows should be checked every 6 months for deficiencies and replaced as they fail.

2.4. HVAC Systems

The Water Utilities Office is served by one main heating plant that consists of a Utica hot water boiler as well as several rooftop units. The rooftop units provide heating as well as cooling and ventilation to all areas of the building. The building does not contain a local BMS system, instead all setpoints are controlled at a central unit located in the Town Hall building.

2.4.1. Heating

The main source of heating for all areas is provided by the hot water boiler located in the basement mechanical room. This boiler provides hot water for baseboard heating in the office areas, convective heaters in the garage area as well as one air handler in the ceiling above the offices in the basement level. The building also contains two Lennox rooftop units that provide heating as well as cooling and ventilation all the spaces of the building. The building is divided into two main zones for heating, the basement level and the ground level floor. Each zone has one Honeywell non-programmable thermostat installed. Due to the fact that the building is operated 24 hours per day, 365 days per year, upgrading to a programmable thermostat would have little or no advantage. The building is ultimately controlled by the BMS system located in the Town Hall building.

2.4.2. Cooling

All areas of the Water Utilities Office with the exception of the garage are cooled using the two Lennox rooftop units. These units are not original to the building and were observed to be in good condition.

2.4.3. Ventilation

As mentioned above, all areas of the building with the exception of the garage are provided ventilation through rooftop units as well as one air handling unit located above the basement level offices. This unit was observed to be beyond its useful lifetime and is recommended to be replaced.

In addition to the air handling unit, there are three exhaust fans located on the main roof that help rid the building of stale air as well as two exhaust fans dedicated to the garage area. These exhaust fans also help induce fresh air into the building. The exhaust fan located nearest to the garage on the West side of the building was observed to be operating without a fan belt. All other units were observed to be working and in good condition. The garage exhaust fans only operate when a truck is parked in the garage.

2.4.4. Domestic Hot Water

There is one Rheem atmospheric domestic hot water heater located in the building with an input of 40,000 BTUH and a storage capacity of 50 gallons. This domestic hot water heater was observed to be appropriately sized and in good condition. This natural gas hot water heater serves only sinks located within the Water Utilities Office. There have been no reports of domestic hot water problems within the building.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The Water Utilities Office contains mostly efficient lighting. All lighting in the building uses 2', 4' or 8' T8 fixtures with electronic ballasts. However, there are incandescent lamps that SWA recommends replacing with CFL's (Compact Fluorescent Lamps) and some halogen HID fixtures that SWA recommends replacing with pulse start metal halides. SWA also recommends installing 2 occupancy sensors throughout the building to limit the amount of runtime of certain fixtures. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

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

Exterior Lighting - The exterior lighting surveyed during the building audit were found to be 200W and 100W metal halide fixtures. SWA recommends replacing them with 135W and 65W pulse start metal halide lamps.

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Parsippany - Troy Hills Water Utilities Office building and has determined that it would be cost-effective to replace the refrigerators and refrigerated vending machines. 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. Building management should select Energy Star label appliances and equipment when replacing: 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.

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 or lounge areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. refrigerators, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Water

Utilities Office 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 Water Utilities Office does not have any installed elevators.

2.5.4.Process and others electrical systems

The Water Utility Offices contain a semi-manual control system for the entire Parsippany-Troy Hills water district. This control center receives electronic signals from various pumps, water towers, booster stations, etc throughout the water district in order to report information to building staff. This unit was not considered as part of the audit since it is independent of the HVAC system. The unit is assumed to have an electric baseload that has been accounted for in the utility analysis.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Date Installed	Estimated Remaining useful life %
Heating/Cooling	RTU-1; Lennox, 13.3 RLA, 2HP, R-22, 7.5 tons cooling capacity	Roof	Lennox, Model #NCHA16-090-1Y, Serial #5600E 04807	Electricity	1st Floor	2000	33%
Heating/Cooling	RTU-2; Lennox, smaller unit, 50,000 Btuh input, 40,000 Btuh output, R-22, 2 tons cooling capacity	Roof	Lennox, Model #GCS16-024-50-3P, Serial #5601D 01133	Electricity	1st Floor	2001	40%
Heating/Cooling	AHU-1; Lennox air handling unit, 41,000 BTUH input, 1,000 CFM	Basement, attic space above offices	Lennox, Model #B10-41-1P, Serial #5481D0E356	Electricity	Basement level	1981	10%
Heating	Utica, 200,000 BTUH input, DOE Heating cap. 165,000 Bthh, 82% Eff.	Basement, mechanical room	Utica, Model #MGB200HID, Serial #GV12679	Natural Gas	Unit heaters in garage area, baseboard heaters in all office areas, two air handlers in ceiling	1981	20%
Heating	Taco HW circulator pump, 1/25 HP, 3250 RPM, 60 Hz, 1ph	Basement, mechanical room	Taco, Model #007-F5, Serial #NA	Electricity	Basement level	2004	40%
Heating	P-1; Bell & Gossett HHW circulation pump, 1/6HP, 115V, 60 Hz, 1725 RPM, no nameplate info	Basement, mechanical room	Bell &Gossett, ID #M10711, Model #NA, Serial #NA	Electricity	1st Floor	2002	30%
Heating	P-2; Bell & Gossett HHW circulation pump, 1/6HP, 115V, 60Hz, 1725 RPM, no nameplate info	Basement, mechanical room	Bell & Gossett, ID #M10711, Model #NA, Serial #NA	Electricity	1st Floor	2002	30%
Heating	Slant Fin, Fin tube radiation, 1350 BTUH/FT, 180F water, nameplate data taken from drawings	Office Areas	Slant Fin, Series J, Model #JAO-14, Serial #NA	Hot Water	Office Areas	1981	30%
Heating	Three Airtherm garage convective unit heaters, 180F water, 20 degree delta T, nameplate info taken from drawings	Garage Areas	Airtherm, Type FRG and W, Model #NA, Serial #NA	Hot Water	Garage Bays	1981	20%
Domestic Hot Water	Rheem atmospheric domestic hot water heater, gas-fired, Input 40,000 Btu, 50 Gal, 278 therms/year, Energy Guide Model A04754	Basement, mechanical room	Rheem, Serial #RHNG1000A04754, Model #41V50	Natural Gas	All areas	2006	60%
Controls	Honeywell Non-Programmable thermostats, 2 zones (upstairs and downstairs)	Main Floor and Basement level	Honeywell, Model #NA, Serial #NA	Electricity	All areas	1981	30%
Lighting	See Appendix A for details	-	-	-	-	-	-

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 Water Utilities Office, 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 existing windows – The existing windows consist of un-insulated, aluminum-framed windows with a single layer of glazing. At this point in time, it would not be cost effective to upgrade the existing windows based on energy savings alone. As part of a capital improvement plan, SWA suggests that windows are upgraded to newer units that have insulated frames with a thermal break and double-paned glass with a low-e coating. Windows should be addressed if any major renovation of the exterior façade is required.

- Upgrade belt drive exhaust fans – SWA recommends that all rooftop exhaust fans are upgraded from belt drive to direct drive fans as the exhaust fans begin to fail. Upgrading these exhaust fans will not increase energy savings significantly; however they will reduce maintenance costs. Direct drive fans are easily adjusted with a screw driver and do not have any belts that constantly require replacing. Direct drive fans are also easy to calibrate in order to ensure that they are exhausting the correct volume of air at all times.

Category II Recommendations: Operations and Maintenance

- Program all computers for power save mode – Based on field observations, the computers at the building were typically programmed for power save mode in order to reduce electricity consumption. Some computers may not be programmed correctly or as efficiently as possible. SWA recommends that all computers are programmed to shut down with the exception of the hard drive when left inactive. One new power strip product called, “Smart strips” are now commercially available that shut down a computer’s components with the help of an occupancy sensors. Smart strips can be purchased for approximately $100.

- Replace fan belt on exhaust fan – The rooftop exhaust fan nearest to the garage, on the West side of the building was observed to be operating without a fan belt. The drive motor was allowed to run without turning the fan. SWA recommends replacing this fan belt immediately since the motor consumes a constant load of electricity and does not exhaust any stale air.

- Bi-annual inspections of exterior walls – SWA recommends that the exterior of the building is inspected twice per year as part of a preventative maintenance plan. Exterior walls should be inspected with a focus on cracks, pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

- Bi-annual inspections of roof surfaces – SWA recommends that the roof surfaces of the building are inspected twice per year as part of a preventative maintenance plan. The roof surface should be checked with a focus on drainage, penetrations, flashing and seams of the roof.

- Bi-annual inspections of windows/doors – SWA recommends that the windows and exterior doors of the Water Utilities office are inspected at least twice a year. The focus of inspections should be on gaps, cracks, and damage to the windows and doors as well as the frames. Any gaps, cracks, or damage to

weather-stripping or caulking should be repaired or replaced immediately. Some of the window units are beginning to show signs of weathering and cracking around the frames.

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

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install 2 new CFL lamps
	Description of Recommended 5-10 Year Payback ECMs
2	Install 20kW Solar PV array on Garage roof
3	Install 2 new Occupancy Sensors
4	Install 25 new Pulse Start Metal Halide fixtures
	Description of Recommended End of Life Cycle ECMs
5	Replace Lennox air handling unit in office ceiling

ECM#1: *Install 2 new CFL lamps*

Description:

The Water Utilities office currently contains 2 incandescent lights located in storage rooms that should be upgraded to Compact Fluorescent Lamps (CFLs). Typically, you can reduce wattage by 2/3 when replacing incandescent lamps with CFLs and still receive the same light output. CFLs provide a better quality light, use less energy as well as last longer than incandescent lights. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $20
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install 2 new CFL lamps	RS Means	20	0	20	95	0.0	0	0.0	5	21	15	247	1.0	1133.2	75.5	104.7	157	170

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

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#2: *Install 20kW Solar PV array on Garage roof*

Description:

Currently, the Water Utilities Office 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, and recommends at this time that Township of Parsippany - Troy Hills further review installing a 20kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Water Utilities Office is not eligible for a 30% federal tax credit. Instead, Township of Parsippany - Troy Hills may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SRECs at $600 / MWh or best market offer.

The Garage roof is the best location for a 20kW PV installation on the building roofs and away from shade. It is important that the roof is verified to be able to support the weight of the entire PV system before any construction is started. 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 20kW system needs approximately 162 panels which would take up 1,738 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: $120,000
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Install 20kW Solar PV array on Garage roof	Similar Project	140,000	20,000	120,000	23,608	20.0	0	5.9	0	17,766	25	302,582	6.8	152.2	6.1	12.7	109,934	42,270

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (123 Watts, model #ND-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 $20,000.

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. $13,800 has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

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

ECM#3: *Install 2 new Occupancy Sensors*

Description:

Based on field observations, there are 2 areas within the Water Utilities Office that would benefit from occupancy sensors. SWA recommends that these 2 areas are upgraded to occupancy sensors in order to reduce the amount of runtime based on occupancy schedules. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $400
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3	Install 2 new Occupancy Sensors	RS Means	440	40	400	256	0.1	0	0.1	0	43	15	506	9.3	26.5	1.8	6.7	106	458

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations.

Rebates / financial incentives:
NJ Clean Energy Prescriptive Lighting Controls – Wall-mounted occupancy sensors ($20 per control)
Maximum incentive amount is $40.

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 25 new Pulse Start Metal Halides*

Description:

The Water Utilities Office currently contains 20 exterior Probe Start Metal Halide fixtures as well as 5 HID garage bay fixtures that should be upgraded to Pulse Start Metal Halides. Pulse Start Metal Halides provide a better quality light that does not degrade over time. Typically, other type of lighting such as Probe Start Metal Halides and HID are installed with excess power wattages since they degrade constantly over time. Pulse Start Metal halide fixtures will not degrade overtime and therefore, lower wattage fixtures can be used. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $19,506
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4	Install 25 new Pulse Start Metal Halide fixtures	RS Means	20,131	625	19,506	8,191	1.7	0	2.1	591	1,967	15	23,147	9.9	18.7	1.2	5.7	3,641	14,666

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:
NJ Clean Energy – Prescriptive Lighting, Metal halide with pulse start ($25 per fixture)
Maximum incentive amount is $625.

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: *Replace Lennox air handling unit in office ceiling*

Description:

The Water Utilities office uses an air handling unit to help bring distribute heated and cooled air as well as provide ventilation to all of the spaces within the building. This unit is installed in the ceiling above the office space and is original to the building. This unit is 29 years old and is no longer performing as efficiently as designed. This air handling unit contains a hot water heating coil inside and provides additional heat to the building with hot water from the boiler. Replacing the existing air handler will reduce noise caused by the current unit, it will provide better ventilation, deliver heat more efficiently and will save electricity associated with the fan motor.

Installation cost:

Estimated installed cost: $6,091
Source of cost estimate: *RS Means; Published and established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5	Replace Lennox air handling units in office ceiling	RS Means	6,370	279	6,091	618	0	0	0.2	60	164	25	2,790	37.2	-54.2	-2.2	-2.8	-3,301	1,107

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations. Electrical savings are calculated based on the fan motor alone. SWA assumes the existing unit has a 1HP motor with an efficiency of 76.9% that will be upgraded to a newer motor with efficiency 85.1%. The unit is assumed to run 24 hours per day based on the occupancy schedules of the building.

Rebates / financial incentives:
NJ Clean Energy – Electric unitary HVAC, Unitary AC and split systems ($73-$92 per ton)
Maximum incentive amount is $279.

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. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Pleases see the above recommended ECM#2.

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

CHP is not applicable for this building because of the existing HVAC system and insufficient domestic hot water use.

5.6. Geothermal

Geothermal is not applicable for this building because current HVAC equipment in new.

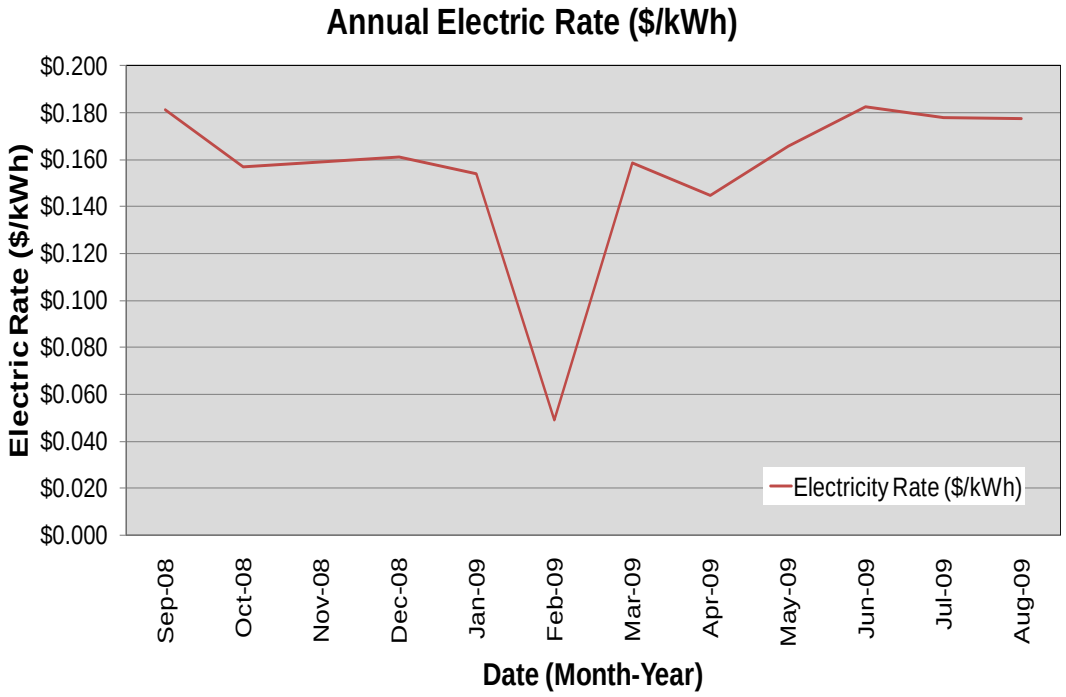
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

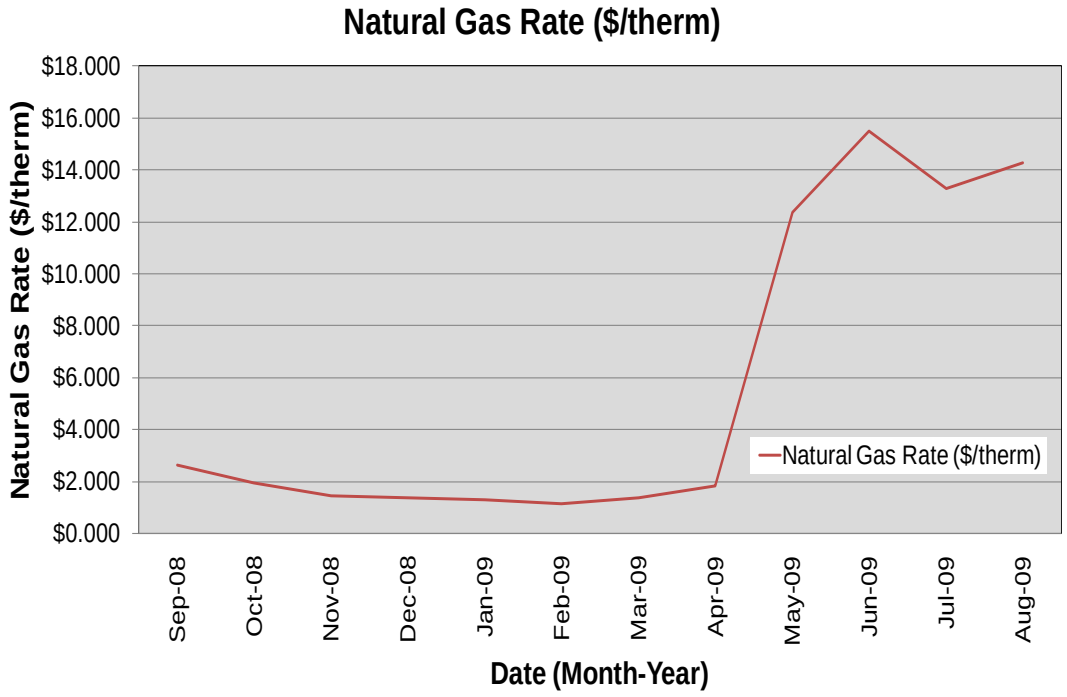
6.1. Energy Purchasing

The Water Utilities Office receives natural gas via one incoming meter. New Jersey Natural Gas supplies gas to the building. There is not an 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 Water Utilities Office from JCP&L without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations of 24% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 93% over the most recent 12 month period.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $1.55/therm for natural gas. Currently, the electricity rate for Water Utilities Office is $.168/kWh, which means there is a potential cost savings of $1,174 per year. The current natural gas rate for the Water Utilities Office is $1.458/therm which is better than the average natural gas cost. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that Township of Parsippany - Troy Hills further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Water Utilities Office. Appendix B contains a complete list of

third party energy suppliers for the Township of Parsippany - Troy Hills service area. Township of Parsippany - Troy Hills 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.





6.2. Energy Procurement strategies

Also, the Water Utilities Office 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 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

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

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 of Parsippany - Troy Hills Water Utilities Office

Location			Existing Fixture Information											Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings	Total Savings
1	1	Meeting Room	Parabolic	E	4'T8	4	2	32	S	4	365	6	262	409	N/A	Parabolic	4'T8	E	S	4	2	32	4	365	6	262	409	0	0	0
2	1	Hallway	Parabolic	E	2'T8	10	2	17	S	24	365	3	343	3,241	N/A	Parabolic	2'T8	E	S	10	2	17	24	365	3	343	3,241	0	0	0
3	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	11	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	11	105	0	0	0
4	1	Hallway	Parabolic	E	4'T8	4	2	32	S	24	365	6	262	2,453	N/A	Parabolic	4'T8	E	S	4	2	32	24	365	6	262	2,453	0	0	0
5	1	Office	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
6	1	Office	Parabolic	E	4'T8	3	2	32	S	8	365	6	198	613	N/A	Parabolic	4'T8	E	S	3	2	32	8	365	6	198	613	0	0	0
7	**1**	**Mechanical Room**	**Parabolic**	**E**	**4'T8**	**6**	**2**	**32**	**S**	**4**	**365**	**6**	**390**	**613**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**2**	**32**	**3**	**365**	**6**	**390**	**460**	**0**	**153**	**153**
8	**1**	**Lunch Room**	**Parabolic**	**E**	**4'T8**	**4**	**2**	**32**	**S**	**8**	**365**	**6**	**262**	**818**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**2**	**32**	**6**	**365**	**6**	**262**	**613**	**0**	**204**	**204**
9	**1**	**Storage Room**	**Screw-in**	**N**	**Inc**	**1**	**1**	**100**	**S**	**2**	**365**	**0**	**100**	**73**	**CFL**	**Screw-in**	**CFL**	**N**	**S**	**1**	**1**	**35**	**2**	**365**	**0**	**35**	**26**	**47**	**0**	**47**
10	1	Bathroom Men	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
11	1	Bathroom Women	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
12	1	Office	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
13	1	Office	Parabolic	E	4'T8	4	2	32	S	8	365	6	262	818	N/A	Parabolic	4'T8	E	S	4	2	32	8	365	6	262	818	0	0	0
14	**1**	**Storage Room**	**Screw-in**	**N**	**Inc**	**1**	**1**	**100**	**S**	**2**	**365**	**0**	**100**	**73**	**CFL**	**Screw-in**	**CFL**	**N**	**S**	**1**	**1**	**35**	**2**	**365**	**0**	**35**	**26**	**47**	**0**	**47**
15	1	Staircase	Parabolic	E	4'T8	2	1	32	S	24	365	3	67	613	N/A	Parabolic	4'T8	E	S	2	1	32	24	365	3	67	613	0	0	0
16	1	Hallway	Screw-in	N	CFL	1	1	15	S	24	365	0	15	131	N/A	Screw-in	CFL	N	S	1	1	15	24	365	0	15	131	0	0	0
17	1	Vestibule	Screw-in	N	CFL	2	1	15	S	24	365	0	30	263	N/A	Screw-in	CFL	N	S	2	1	15	24	365	0	30	263	0	0	0
18	B	Mechanical Room	Parabolic	E	4'T8	12	2	32	S	2	365	6	774	613	N/A	Parabolic	4'T8	E	S	12	2	32	2	365	6	774	613	0	0	0
19	B	Locker Room	Parabolic	E	4'T8	2	2	32	S	12	365	6	134	613	N/A	Parabolic	4'T8	E	S	2	2	32	12	365	6	134	613	0	0	0
20	B	Showers Men	Screw-in	N	CFL	2	1	15	S	12	365	0	30	131	N/A	Screw-in	CFL	N	S	2	1	15	12	365	0	30	131	0	0	0
21	B	Boiler Room	Parabolic	E	4'T8	6	2	32	S	2	365	6	390	307	N/A	Parabolic	4'T8	E	S	6	2	32	2	365	6	390	307	0	0	0
22	B	Bathroom Men	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
23	B	Meeting Room	Parabolic	E	4'T8	3	2	32	S	4	365	6	198	307	N/A	Parabolic	4'T8	E	S	3	2	32	4	365	6	198	307	0	0	0
24	B	Bathroom Women	Parabolic	E	4'T8	2	2	32	S	8	365	6	134	409	N/A	Parabolic	4'T8	E	S	2	2	32	8	365	6	134	409	0	0	0
25	1	Garage	Parabolic	E	8'T8	16	4	59	S	24	365	26	3,802	36,722	N/A	Parabolic	8'T8	E	S	16	4	59	24	365	26	3,802	36,722	0	0	0
26	**1**	**Garage**	**HID**	**N**	**Hal**	**5**	**1**	**100**	**S**	**24**	**365**	**25**	**525**	**5,475**	**PSMH**	**Screw-in**	**PSMH**	**N**	**S**	**5**	**1**	**65**	**24**	**365**	**14**	**339**	**3,460**	**2,015**	**0**	**2,015**
27	1	Garage	Exit Sign	N	LED	2	1	5	N	24	365	1	11	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	11	105	0	0	0
28	1	Garage	Parabolic	E	4'T8	2	2	32	S	24	365	6	134	1,226	N/A	Parabolic	4'T8	E	S	2	2	32	24	365	6	134	1,226	0	0	0
29	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**10**	**1**	**200**	**T**	**12**	**365**	**50**	**2,050**	**10,950**	**PSMH**	**Exterior**	**PSMH**	**N**	**T**	**10**	**1**	**135**	**12**	**365**	**29**	**1,379**	**7,183**	**3,767**	**0**	**3,767**
30	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**8**	**1**	**200**	**T**	**12**	**365**	**50**	**1,650**	**8,760**	**PSMH**	**Exterior**	**PSMH**	**N**	**T**	**8**	**1**	**135**	**12**	**365**	**29**	**1,109**	**5,747**	**3,013**	**0**	**3,013**
31	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**2**	**1**	**100**	**T**	**12**	**365**	**25**	**225**	**1,095**	**PSMH**	**Exterior**	**PSMH**	**N**	**T**	**2**	**1**	**65**	**12**	**365**	**14**	**144**	**692**	**403**	**0**	**403**
Totals:						**126**	**52**	**1507**				**286**	**13,029**	**78,980**						**126**	**52**	**1,177**				**11,420**	**69,330**	**9,293**	**358**	**9,651**

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

Appendix B: Third Party Energy Suppliers (ESCOs)

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

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

Third Party Gas Suppliers for NJNG Service Territory	Telephone & Web Site
Cooperative Industries	(800) 628-9427
412-420 Washington Avenue	www.cooperativenet.com
Belleville, NJ 07109	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
Gateway Energy Services Corp.	(800) 805-8586
44 Whispering Pines Lane	www.gesc.com
Lakewood, NJ 08701	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
Intelligent Energy	(800) 724-1880
2050 Center Avenue, Suite 500	www.intelligentenergy.org
Fort Lee, NJ 07024	
Metromedia Energy, Inc.	(877) 750-7046
6 Industrial Way	www.metromediaenergy.com
Eatontown, NJ 07724	
MxEnergy, Inc.	(800) 375-1277
510 Thornall Street, Suite 270	www.mxenergy.com
Edison, NJ 08837	
NATGASCO (Mitchell Supreme)	(800) 840-4427
532 Freeman Street	www.natgasco.com
Orange, NJ 07050	
NJ Gas & Electric	(866) 568-0290
1 Bridge Plaza, Fl. 2	www.NewJerseyGasElectric.com
Fort Lee, NJ 07024	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main Street	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Woodruff Energy	(800) 557-1121
73 Water Street	www.woodruffenergy.com
Bridgeton, NJ 08302	

Appendix C: Glossary and Method of Calculations

Glossary of ECM Terms

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

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

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

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

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

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

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

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

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

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

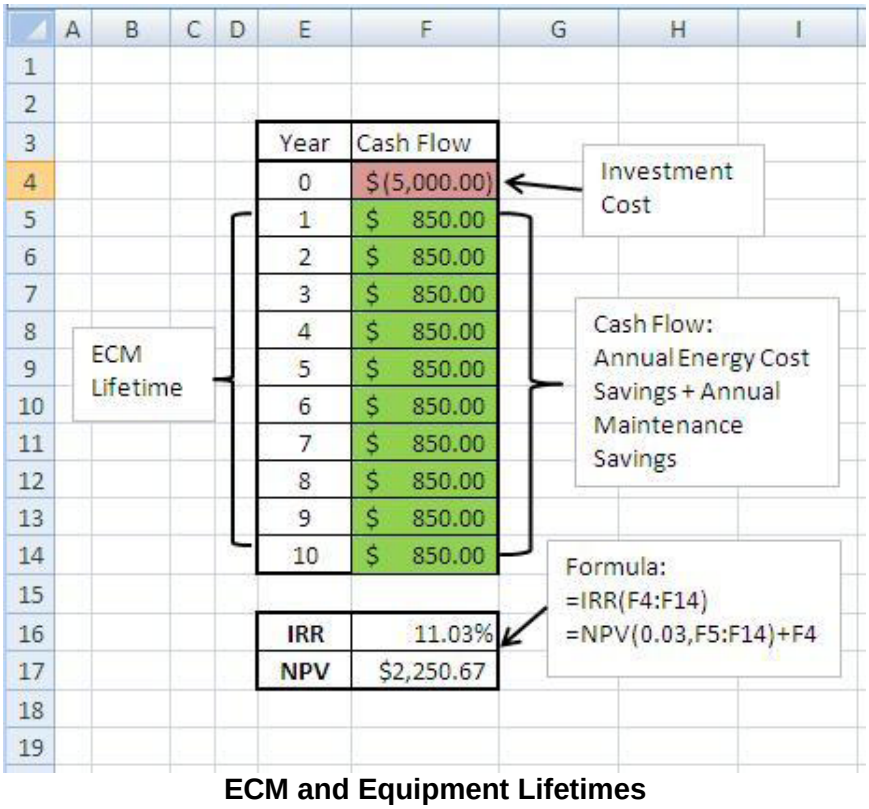
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime

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

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

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



ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.
Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

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

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