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May 5, 2010

Local Government Energy Program
Energy Audit Report

Township of Parsippany – Troy Hills

Sewer Pump Station #4
40 Old Bloomfield Avenue
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 Sewer Pump Station #4 building located at 40 Old Bloomfield Avenue, 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 Sewer Pump Station #4 building, located at 40 Old Bloomfield Avenue was opened in 1964, when work was completed as a new construction. The Parsippany - Troy Hills Sewer Pump Station #4 consists of approximately 2,346 square feet of conditioned space with no permanent occupancy however, workers do frequent the building as part of both scheduled and emergency work. The building is home to mechanical rooms for both the sewage system and water system with a focus on motors and pumps. It is not open to the public and access is restricted to authorized personnel. The mechanical equipment housed in the building is used in operation all day every day, as loads require.

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 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The Parsippany - Troy Hills Sewer Pump Station #4 building, located at 40 Old Bloomfield Avenue was opened in 1964, when work was completed as a new construction. The Parsippany - Troy Hills Sewer Pump Station #4 consists of approximately 2,346 square feet of conditioned space with no permanent occupancy however, workers do frequent the building as part of both scheduled and emergency work. The building is home to mechanical rooms for both the sewage system and water system with a focus on motors and pumps. It is not open to the public and access is restricted to authorized personnel. The mechanical equipment housed in the building is in operation all day every day with no exceptions.

Based on the field visit performed by the SWA staff on October 23rd, 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, natural gas and electric usage.

Existing conditions

From September 2008 through August 2009, the period of analysis for this audit, the building consumed 266,880 kWh or $46,384 worth of electricity at an approximate rate of $0.174/kWh and 88 therms or $134 worth of natural gas at an approximate rate of $1.523 per therm. The joint energy consumption for the building, including both electricity and fossil fuel, was 919 MMBtus of energy that cost a total of $46,518.

SWA has entered energy information about the Sewer Pump Station #4 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 392.2 kBtu/sq ft yr compared to the national average of a building consuming 104.0 kBtu/sq ft yr. The energy use intensity for Sewer Pump Station #4 appears extremely high because it compares process equipment such as pumps and motors for a small floor area and is being compared to typical commercial buildings. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 3.9 kBtu/sqft yr, with an additional 8.6 kBtu/sq ft yr from the recommended ECMs and 0.0 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Recommendations

Implementing this report's recommendations will reduce use by approximately 12.5 kBtu/ft^{2}yr, which would decrease the building's energy use intensity to 379.7kBtu/ft^{2}yr.

The Sewer Pump Station #4 is a building primarily used for sewage pumping. The building has a limited heating system mainly to prevent freezing and no space cooling system. There are three ceiling-mounted AC units, however these are special units used to cool electrolytes for sewage treatment process. Building staff noted that existing equipment such as pump motors are high efficiency type. Building staff also noted that there is currently an equipment replacement plan for when pump motors fail or extend beyond their service life. As a general recommendation, SWA recommends that all energy using equipment is always purchased with energy efficiency in mind. SWA recommends a package of measures that addresses typical building lighting as well as introduces solar photovoltaic technology in order to offset the base electric load of the building.

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

- Purchase highest efficiency motors when they require replacement

Category II Recommendations: Operations and Maintenance

- Maintain roofs
- Provide weather stripping / air sealing
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends **1** Energy Conservation Measure (ECM) for the Sewer Pump Station #4 that is summarized in the following Table 1. The total investment cost for this ECM is **$225**. SWA estimates a first year savings of **$526** with a simple payback of **0.4 years**. SWA also recommends **1** ECM with a 5-10 year payback that is summarized in Table 2 and no End of Life Cycle ECMs.

The implementation of all the recommended ECMs would reduce the building electric usage by 8,603 kWh annually, or 3% of the building's current electric consumption. Natural gas is used primarily by the generator and therefore there are no recommended measures that reduce gas usage. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Sewer Pump Station #4 by **15,404 lbs of CO_2**, which is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 37 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 $0.024/kWh, which would have equated to $6,405 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, recently rolled out, could also assist to cover up to 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 two 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 15 new CFL lamps	RS Means	225	0	225	2,701	0.1	0	3.9	56	526	5	2,395	0.4	965	193	233	2,170	4,836
	TOTALS		**225**	**0**	**225**	**2,701**	**0.1**	**0**	**3.9**	**56**	**526**	**-**	**2,395**	**0.4**	**-**	**-**	**-**	**2,170**	**4,836**

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 5 kW solar PV system	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	8.6	0	4,027	25	68,584	7.4	129	5	11	22,792	10,568
	TOTALS		**35,000**	**5,000**	**30,000**	**5,902**	**5.0**	**0**	**8.6**	**0**	**4,027**	**-**	**68,584**	**7.4**	**-**	**-**	**-**	**22,792**	**10,568**

1. HISTORIC ENERGY CONSUMPTION

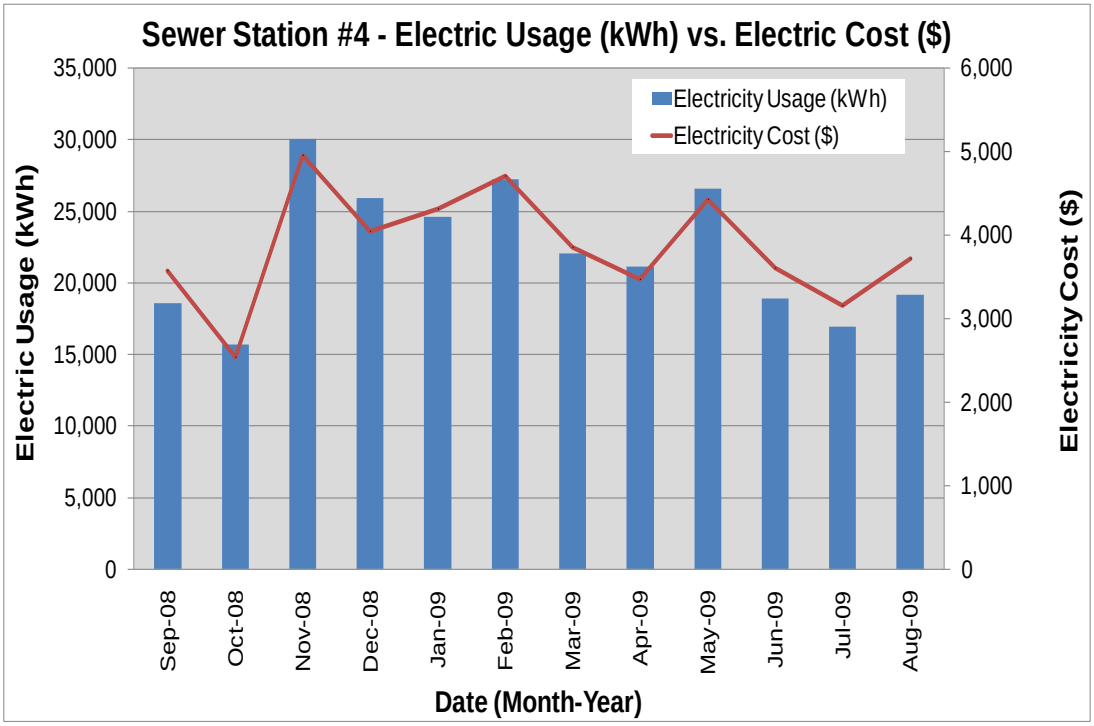
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **September 2008 through August 2009** (period of analysis) that were received from the utility companies supplying the Sewer Pump Station #4 with electric and natural gas.

Electricity - Sewer Pump Station #4 buys electricity from JCP&L at **an average rate of $0.174/kWh** based on 12 months of utility bills from September 2008 to August 2009. The Sewer Pump Station #4 purchased **approximately 266,880 kWh or $46,384 worth of electricity** in the previous year. The Sewer Pump Station #4 is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **110.4 kW** and an annual peak demand of **153.0 kW.**

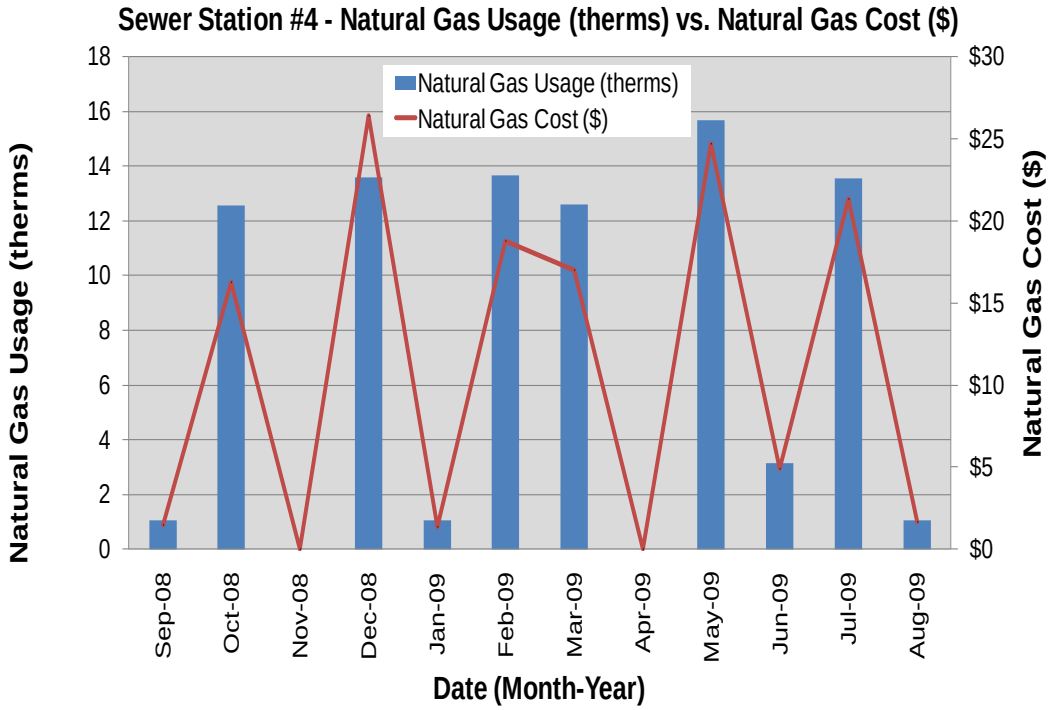
Natural gas - The Sewer Pump Station #4 is currently served by one meter for natural gas. The Sewer Pump Station #4 currently buys natural gas from New Jersey Natural Gas (NJNG) at **an average aggregated rate of $1.523/therm** based on 12 months of utility bills for September 2008 to August 2009. The Sewer Pump Station #4 purchased **approximately 88 therms or $134 worth of natural gas** in the previous year.

The following chart shows electricity use versus cost for the Sewer Pump Station #4 based on utility bills for the 12 month period of September 2008 to August 2009.



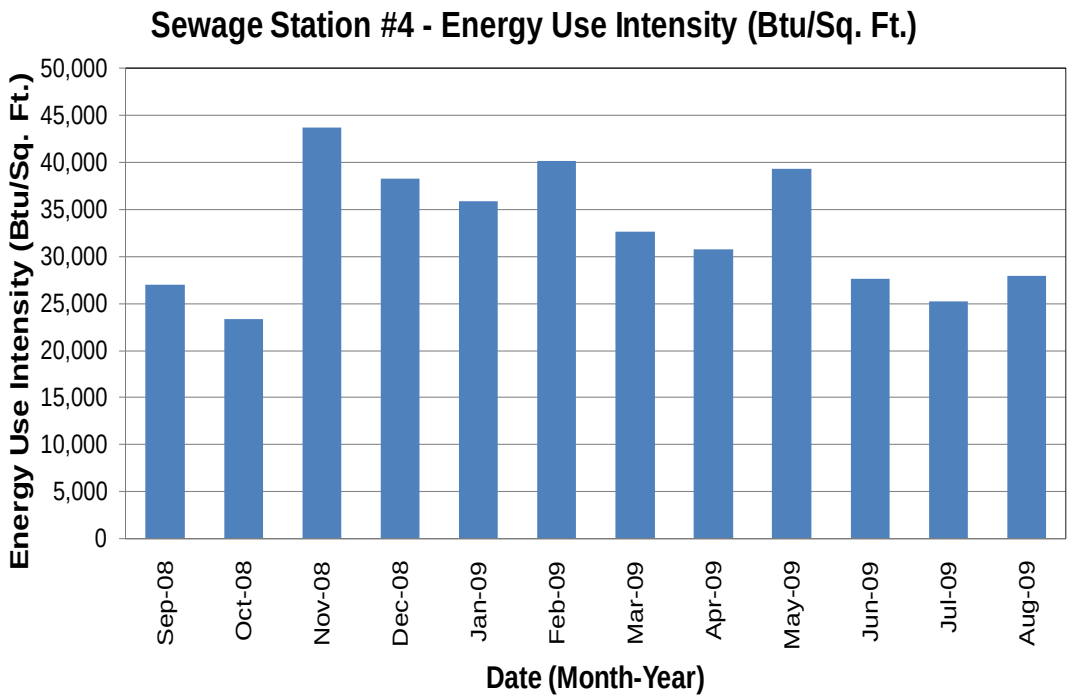
Electricity use follows a trend related to pump motor usage and does not necessarily correspond to building HVAC usage. The cost of electricity fluctuates as expected with usage.

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 and a chart showing natural gas consumption following the "heating degree days" curve.



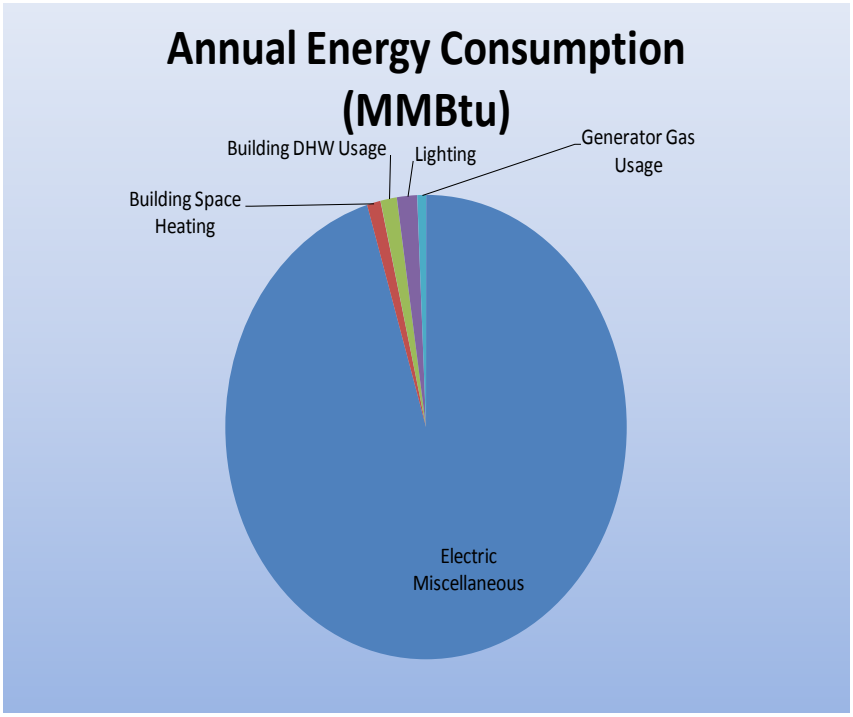
In the above chart, the natural gas use does not follow the typical heating trend as expected. Natural gas is used for the generator only. Natural gas usage reflects the usage of gas for starting the generator and letting it run for 30 minutes once per week as part of a system test. Fluctuations in billing analysis are caused by estimated bills being correct with actual readings. It is common for utility companies to estimate multiple bills per year for low gas usage buildings.

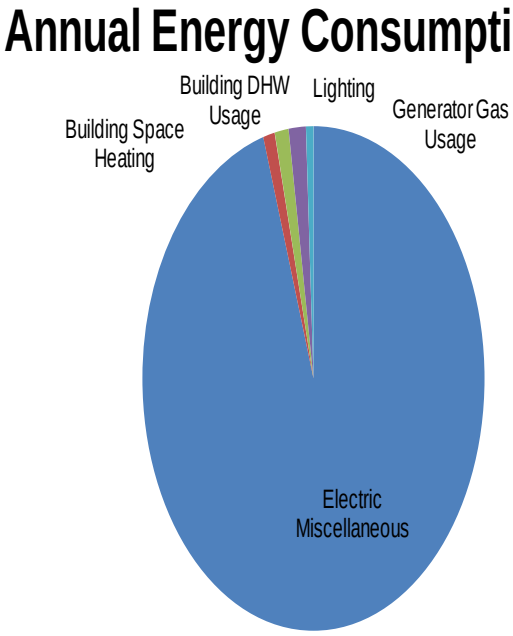
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the building based on utility bills for the 12 month period of September 2008 to August 2009. As expected it is dominated by the trends shown in the electric bills due to the minimal amount of natural gas used.



The following table and chart pies show energy use for the Sewer Pump Station #4 based on utility bills for the 12 month period of September 2008 to August 2009. Note electrical cost at $51/MMBtu of energy is more than 3 times as expensive to use as natural gas at $15/MMBtu.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	874	95%	$44,574	96%	51
Building Space Heating	10	1%	$510	1%	51
Building DHW Usage	12	1%	$612	1%	51
Lighting	15	2%	$765	2%	51
Generator Gas Usage	6	1%	$107	0%	17
Totals	917	100%	$46,568	100%	
Total Electric Usage	911	99%	$46,384	100%	51
Total Gas Usage	8	1%	$134	0%	15
Totals	919	100%	$46,518	100%	

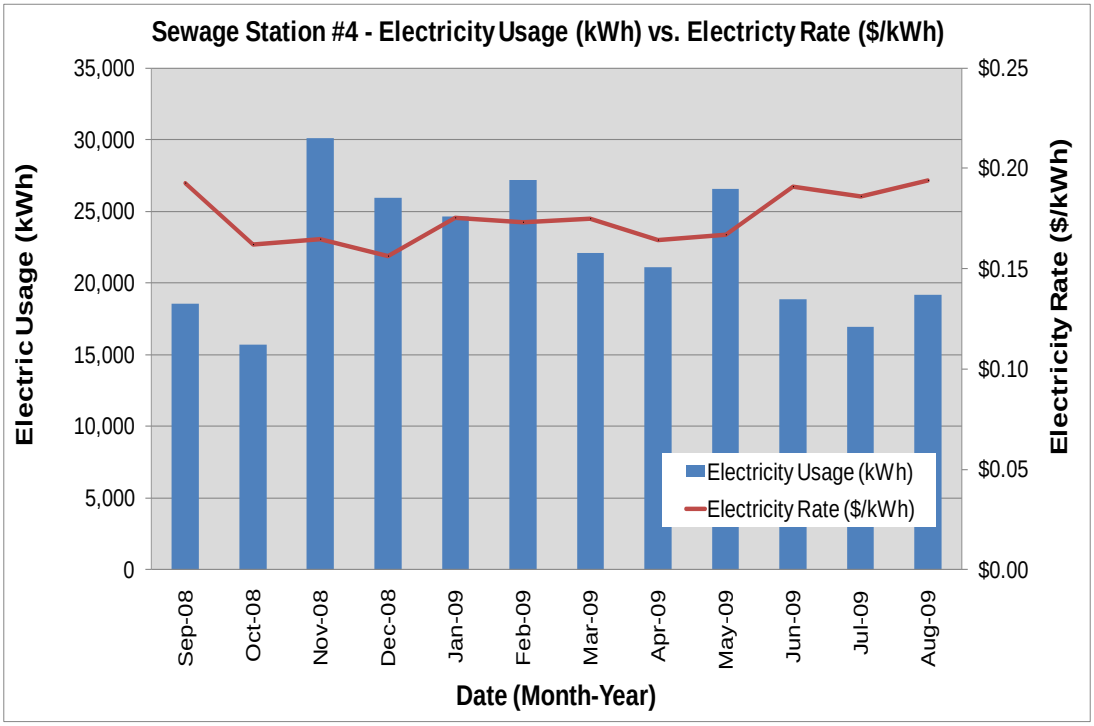




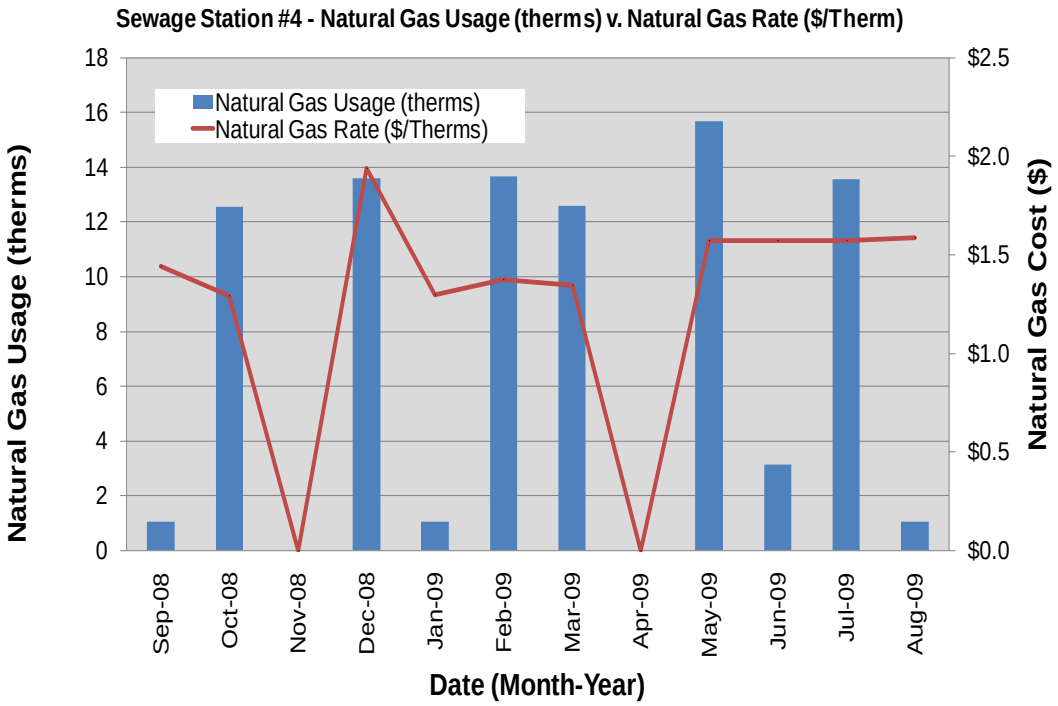
1.2. Utility rate analysis

The Sewer Pump Station #4 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 Sewer Pump Station #4 currently pays an average rate of approximately $0.174/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 Sewer Pump Station #4 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 Sewer Pump Station #4 currently. The average aggregated rate (supply and transport) for the meter is approximately $1.523/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 Sewer Pump Station #4 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.



1.3. Energy benchmarking

SWA has entered energy information about the Sewer Pump Station #4 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 392.2 kBtu/sq ft yr compared to the national average of a building consuming 104.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 3.9 kBtu/sqft yr, with an additional 8.6 kBtu/sq ft yr from the recommended ECMs and 0.0 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, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Sewer Pump Station #4

Building ID: 1974112
For 12-month Period Ending: August 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: December 28, 2009

Facility	**Facility Owner**	**Primary Contact for this Facility**
Sewer Pump Station #4 40 Old Bloomfield Avenue Parsippany, NJ 07504	Township of Parsippany - Troy Hills 1001 Parsippany Boulevard Parsippany, NJ 07054	Jasmine L. Lim 1001 Parsippany Boulevard Parsippany, NJ 07054

Year Built: 1964
Gross Floor Area (ft²): 2,346

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	910,595
Natural Gas (kBtu)[4]	9,507
Total Energy (kBtu)	920,102
Energy Intensity[5]	
Site (kBtu/ft²/yr)	392
Source (kBtu/ft²/yr)	1301
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	139
Electric Distribution Utility	
Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	511%
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 Sewer Pump Station #4 building, located at 40 Old Bloomfield Avenue was opened in 1964, when work was completed as a new construction. It consists of approximately 2,346 square feet of conditioned space with one above grade floor and two below grade floors. The building is home to mechanical rooms for both the sewage system and water system with a focus on motors and pumps. The sewage equipment is isolated from the water equipment and is only accessible from a separate entrance. It is not open to the public and access is restricted to authorized personnel. The mechanical equipment housed in the building is in operation all day every day with no exceptions.

2.2. Building occupancy profiles

There is no permanent occupancy however, workers do frequent the building as part of both scheduled and emergency work and occupancy will not increase beyond that since the building is not open to the public and access is restricted to authorized personnel. The mechanical equipment housed in the building is in operation all day every day with no exceptions.

2.3. Building envelope

2.3.1.Exterior Walls

There are three typical types of exterior walls at Sewer Pump Station #4. Most of the exterior wall surface is a 4” layer of red masonry brick with an 8” layer of structural glazed tile. There is also a small section with an exterior finish of 4” cast stone panels. Additionally, a small amount of the exterior wall for the first below grade floor protrudes above grade and is constructed of 12” concrete layer with a rubbed finish.

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 where the masonry wall is beginning to show signs of damage as well as some cracked concrete. 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 Sewer Pump Station #4 is a flat roof that is slightly sloped for drainage. The surface of the roof is a membrane and built up roofing, above a 5" layer of lightweight concrete fill and structural beams. 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.

2.3.3. Base

The building's base is an 18" concrete slab below grade and the typical floors are constructed of 8" concrete slabs. 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 around the perimeter of the building slab.

2.3.4. Windows

The existing windows of the Sewer Pump Station #4 are operable aluminum frame units with four push out casement units combined into one installation with single layers of glazing and a large concrete window sill. The windows appear to be in good age-appropriate condition. Installation of new windows would not be economically viable, but as a best practice, SWA recommends that all

windows be inspected at least once 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.

Typical window installation

2.3.5.Exterior doors

There exterior doors at Sewer Pump Station #4 are metal frame insulated hollow core metal doors with sidelight windows built into the doors. The exterior doors are in adequate condition however some of the weather-stripping is missing. 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.

Typical exterior door installation

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 Sewer Pump Station #4 heating system consists of a single, McQuay ceiling-mounted electric unit heater. The building contains three McQuay ceiling-mounted AC units that cool electrolyte to aid in the Sewage Treatment process. The structure acts as a district sewage booster station to pump sewage from the specified district to the main Sewage Treatment Plant. The building contains three large pumps that are operated in three stages and each controlled by a Variable Speed Drive (VSD). The pumps fire in three stages; with Pump #1 being used all the time, Pump #2 being used in times of heavy rain and when there is excess sewage and water, and Pump #3 serves as additional pumping capacity and is never used.

2.4.1. Heating

The heating system consists of a single, McQuay ceiling-mounted 7.5 kW electric unit heater. This unit heater is used primarily for maintaining adequate temperatures in the sewage pump station for freezing prevention. The motors within the building prevent a substantial amount of heat and therefore the unit heater is rarely used.

2.4.2. Cooling

The cooling system within the Sewer Pump House is not used for building load cooling, but cools electrolytes that are used in the sewage treatment process. The cooling system consists of three (3) McQuay air conditioning units that circulate electrolytes based on wet well levels.

2.4.3. Ventilation

The structure contains vents that help introduce fresh air into the building and exhaust fans help expel stale air.

2.4.4. Domestic Hot Water

There is one Bradford-White Hydrojet electric water heater. This domestic hot water heater was observed to be appropriately sized and in good condition. This electric hot water heater serves only sinks located within the Sewer Pump Station #4. There have been no reports of domestic hot water problems within the building.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Sewer Pump Station #4 contains mostly inefficient lighting. All lighting in the building uses incandescent fixtures that SWA recommends replacing with CFL's (Compact Fluorescent Lightbulb) and some CFL's as well. 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 was found to be 15W CFL's (Compact Fluorescent Lightbulb) and 100W halogen fixtures. SWA recommends replacing the halogen fixtures with 65W CFL's (Compact Fluorescent Lightbulb).

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Parsippany - Troy Hills Sewer Pump Station #4 building and has determined that it would be cost-effective to replace any plug-load appliances.

2.5.3. Elevators

The Sewer Pump Station #4 does not have any installed elevators.

2.5.4. Process and others electrical systems

Pump Station #4 uses a system of three pumps and motors to act as a booster system for the local sewage district. This pump station receives sewage from within its district, treats the sewage and then acts as a booster station to send sewage to the main sewage treatment plant, where it can be treated further. According to building staff, the Sewage treatment facilities are following a replacement plan to replace motors and pumps as they fail. The three pumps are operated in stages with Pump 1 being operated most of the time, the second pump used only during heavy rain storms and the third pump used only as backup. As a general recommendation, SWA recommends that the most efficient equipment, especially motors are included as a capital improvement plan. The current pump motors did not contain nameplate information and building maintenance informed SWA that they were recently rebuilt and were most likely standard efficiency. Due to the special use of these pump motors as process equipment; a further technical study is needed to calculate the replacement of the pump motors as well as upgrading of VFD drives. According to building staff, the Township of Parsippany-Troy Hills has recently submitted a Request for Proposal (RFP) to different engineering firms to study and implement new pumps.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Installed Date	Estimated Remaining useful life %
Heating	McQuay 7.5 kW electric unit heater, convective heater, no nameplate	Ceiling of builing, inside	McQuay, Model #NA, Serial #NA	Electricity	All Areas	1998	30%
Electrolyte Cooling	Three (3) McQuay AC units, circulates electrolytes based on wet well levels, keeps electrolytes cool	First below grade level	McQuay, Model #NA, Serial #NA	Electricity	All Areas	1998	30%
Pumps	Three (3) Universal electric motors, 100 HP, 3PH, custom built motors with standard efficiency, located on bottom level, each pump (motor) represents three stages of pumping, maintenance staff noted that they have never seen 3rd pump come on and rarely sees the second pump (only on heavy rainfall days), these pumps are controlled by Variable Speed Drives (VSDs)	Second below grade level	Universal, Type #SNV584P, Serial #E54873	Electricity	All Areas	2008	80%
Pumps	Three (3) small pump motors for electrolyte pumps located on first level, 1/3 HP	Above grade level	Emerson, Model #S55NXLLY-8257, Serial #NA	Electricity	All Areas	2000	40%
Transformer	Quiet Transformer, could not access nameplate	Inside Well house, first level	Quiet Transformer, Model #NA, Serial #NA	Electricity	All areas	2000	30%
Domestic Hot Water	Bradford-White Domestic Hot Water Heater, nameplate info could not be accessed	Inside Well house, first level	Bradford-White, Model #NA, Serial #NA	Electricity	All areas	1998	20%
Generator	Caterpillar, Electric Set 300kW, 240V, 3PH, 1200 RPM	Exterior of Pump House	Caterpillar, Model #G379A, Serial #NA	Natural Gas	All areas	2002	40%
Lighting	See Appendix A	-	-	-	-	-	-

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 Sewer Pump Station #4, 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

- Purchase highest efficiency motors (when replacing them) – SWA recommends that the Parsippany-Troy Hills Water and Sewage Department continue to maintain pumps well and always purchase the most efficient motors when possible. Pump houses have high electrical usage that can be reduced, saving significant amounts of money by always using the highest efficiency equipment.

Category II Recommendations: Operations and Maintenance

- Maintain roofs - SWA recommends regular maintenance to verify that roof surfaces are intact and now allowing water to penetrate the envelope of the building.

- Provide weather stripping / air sealing – SWA observed that all windows and doors had proper weather-stripping and air sealing due to their age. As a best practice, SWA recommends that each window and door is inspected twice per year for deficiencies. Any time that a seal has been compromised, building maintenance staff should repair and replace the seal immediately to ensure that thermal barriers are not breached.

- 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 15 new CFL fixtures**
ECM#	**Description of Highly Recommended 0-5 Year Payback ECMs**
2	**Install 5 kW Solar PV system**

ECM#1: *Install 15 new CFL lamps*

Description:
The Sewer Pump Station #4 contains 15 fluorescent lights that are recommended to be replaced with CFLS. SWA recommends that these screw-type incandescent bulbs are replaced with CFL screw-type bulbs. In addition to using less energy while producing the same quality light, there will be operating cost savings associated with each bulb since CFLs have a longer rated lifetime than incandescent bulbs. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $225
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 15 new CFL lamps	RS Means	225	0	225	2,701	0.1	0	3.9	56	526	5	2,395	0.4	965	193	233	2,170	4,836

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 5kW PV system*

Description:

Currently, the Sewer Pump Station #4 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 5kW 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 Sewer Pump Station #4 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.

There are a few locations for a 5kW PV installation on the building roof and away from shade. 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:

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 5 kW solar PV system	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	8.6	0	4,027	25	68,584	7.4	129	5	11	22,792	10,568

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 $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 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. $3,000 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. 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 consists of a single electric unit heater.

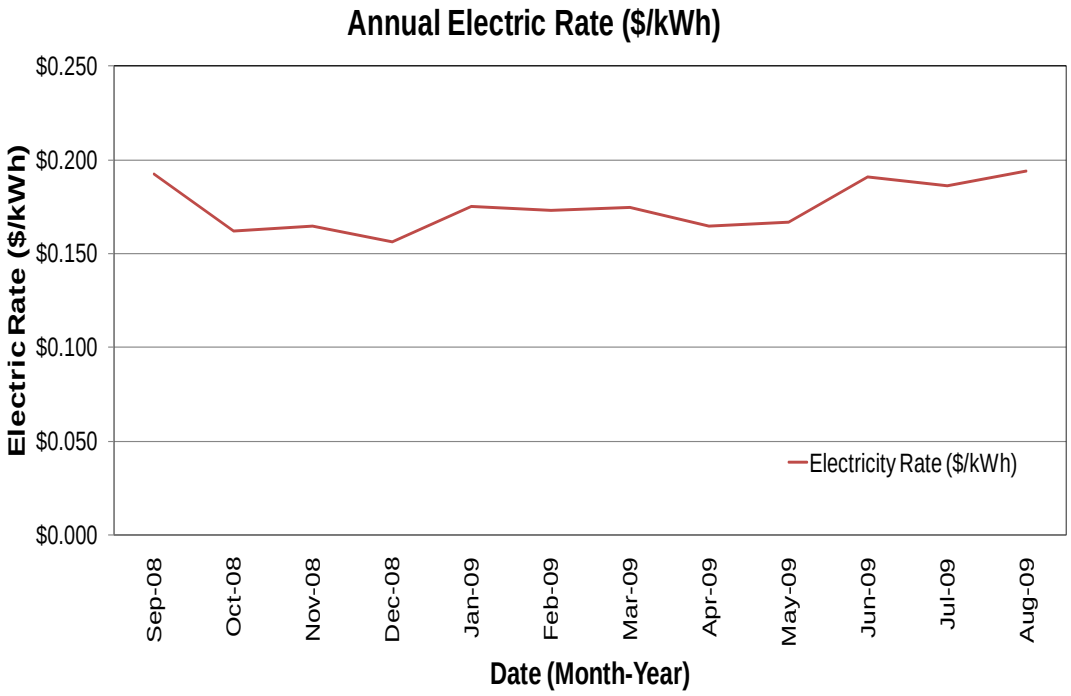
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

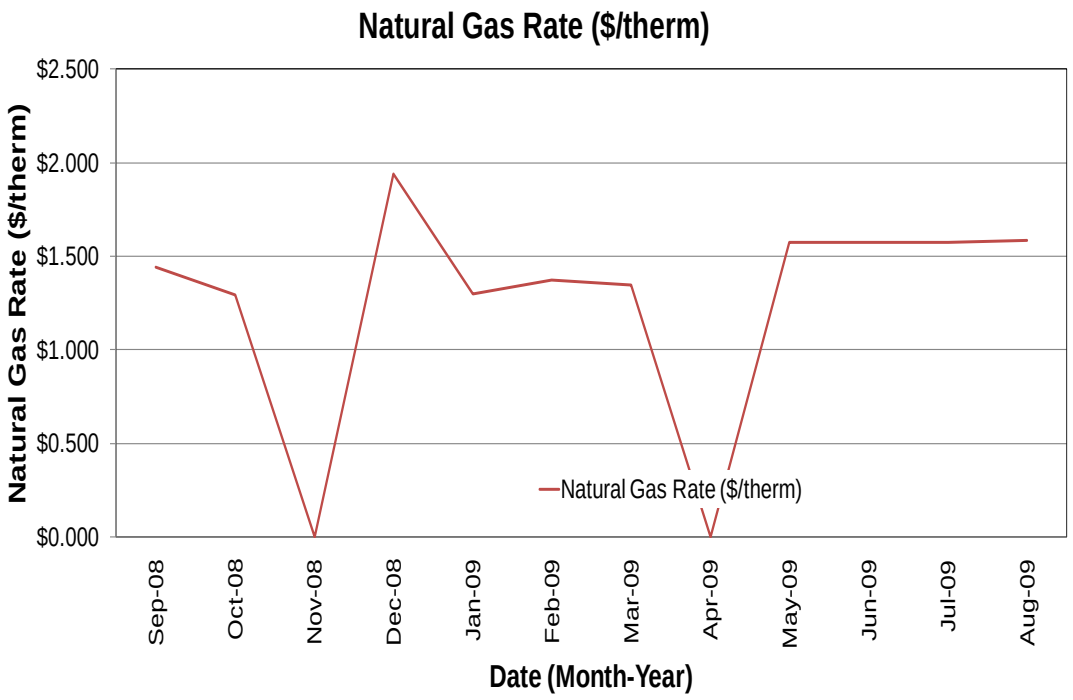
6.1. Energy Purchasing

The Sewer Pump Station #4 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 Sewer Pump Station #4 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 22% over the 12 month period of September 2008 – August 2009. Natural gas bill analysis shows fluctuations up to 33% 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 Sewer Pump Station #4 is $0.174/kWh, which means there is a potential cost savings of $6,405 per year. The current natural gas rate for the Sewer Pump Station #4 is $1.523/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 Sewer Pump Station #4. 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 Sewer Pump Station #4 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 Sewer Pump Station #4

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**	**Mechanical Rm**	**Screw-in**	**E**	**Inc**	**5**	**1**	**60**	**S**	**4**	**365**	**0**	**300**	**438**	**CFL**	**Screw-in**	**CFL**	**E**	**S**	**5**	**1**	**20**	**4**	**365**	**0**	**100**	**146**	**292**	**0**	**292**
2	1	Bathroom	Screw-in	E	CFL	1	1	15	S	2	365	0	15	11	N/A	Screw-in	CFL	E	S	1	1	15	2	365	0	15	11	0	0	0
3	1	Mechanical Rm	Exit Sign	E	LED	1	1	5	S	4	365	1	6	9	N/A	Exit Sign	LED	E	S	1	1	5	4	365	1	6	9	0	0	0
4	B	Staircase	Screw-in	E	CFL	2	1	15	S	24	365	0	30	263	N/A	Screw-in	CFL	E	S	2	1	15	24	365	0	30	263	0	0	0
5	**B**	**Mechanical Rm**	**Screw-in**	**E**	**Inc**	**3**	**1**	**100**	**S**	**4**	**365**	**0**	**300**	**438**	**CFL**	**Screw-in**	**CFL**	**E**	**S**	**3**	**1**	**35**	**4**	**365**	**0**	**105**	**153**	**285**	**0**	**285**
6	**SB**	**Mechanical Rm**	**Screw-in**	**E**	**Inc**	**3**	**1**	**100**	**S**	**4**	**365**	**0**	**300**	**438**	**CFL**	**Screw-in**	**CFL**	**E**	**S**	**3**	**1**	**35**	**4**	**365**	**0**	**105**	**153**	**285**	**0**	**285**
7	**SB**	**Staircase**	**Screw-in**	**E**	**Inc**	**3**	**1**	**60**	**S**	**24**	**365**	**0**	**180**	**1,577**	**CFL**	**Screw-in**	**CFL**	**E**	**S**	**3**	**1**	**20**	**24**	**365**	**0**	**60**	**526**	**1,051**	**0**	**1,051**
8	SB	Staircase	Screw-in	E	CFL	1	1	15	S	24	365	0	15	131	N/A	Screw-in	CFL	E	S	1	1	15	24	365	0	15	131	0	0	0
9	SB	Staircase	Screw-in	E	CFL	1	1	15	S	24	365	0	15	131	N/A	Screw-in	CFL	E	S	1	1	15	24	365	0	15	131	0	0	0
10	**Ext**	**Exterior**	**Exterior**	**E**	**Hal**	**1**	**1**	**100**	**S**	**24**	**365**	**25**	**125**	**1,095**	**CFL**	**Exterior**	**CFL**	**E**	**S**	**1**	**1**	**35**	**24**	**365**	**0**	**35**	**307**	**788**	**0**	**788**
Totals:						**21**	**10**	**485**				**26**	**1,286**	**4,531**						**21**	**10**	**210**				**486**	**1,830**	**2,701**	**0**	**2,701**

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

TO USERS: ONCE ALL ROOMS ARE ADDED, DELETE ROWS NOT USED. MAKE SURE TO DELETE ENTIRE ROW, DO NOT SHIFT CELLS!

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

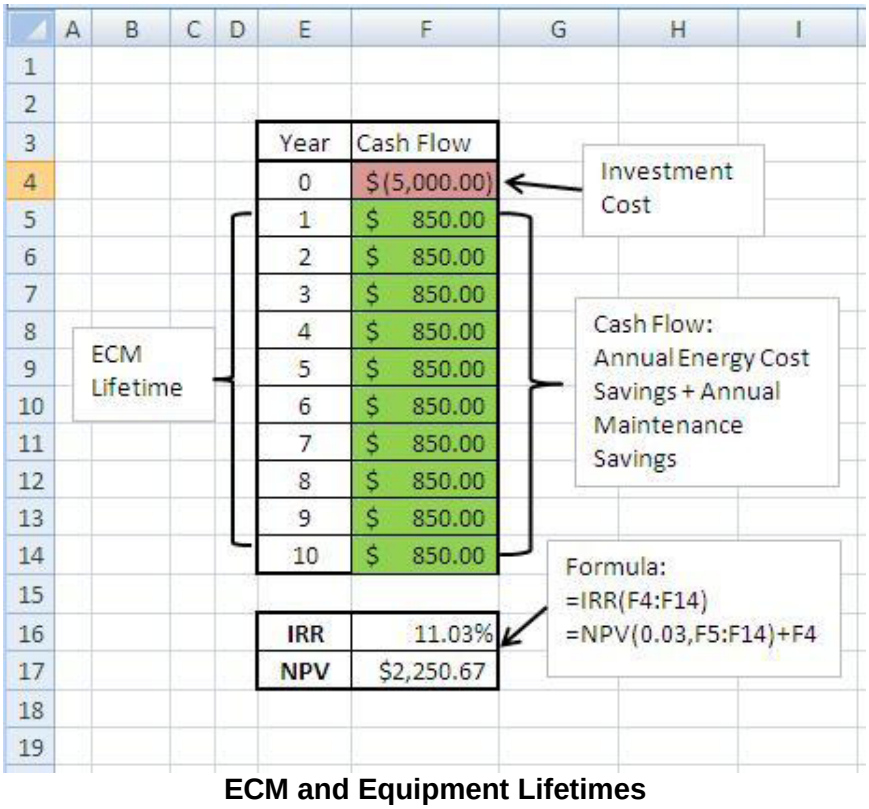
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime

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.

NJCEP C & I Lifetimes

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