Steven Winter Associates, Inc. 293 Route 18 South Telephone (866) 676-1972
Building System Consultants East Brunswick, NJ 08816 Web: www.swinter.com

May 5, 2010

Local Government Energy Program
Energy Audit Report

Township of Parsippany – Troy Hills

Park Road Booster Station
Park 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 Park Road Booster Station building located at Park 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 Park Road Booster Station building was recently upgraded in 2005 when work was completed for a new addition. The Parsippany - Troy Hills Park Road Booster Station consists of approximately 200 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 a mechanical room with a focus on motors and pumps and also houses an unoccupied basement as well as the ground floor. 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.

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 Park Road Booster Station building located at Park Road was built circa 1964 and was recently upgraded in 2005.. The Parsippany - Troy Hills Park Road Booster Station consists of approximately 200 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 a mechanical room with a focus on motors and pumps and also houses an unoccupied basement as well as the ground floor. 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 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 512,960 kWh or $80,718 worth of electricity at an approximate rate of $0.157/kWh. The total energy consumption for the building was 1,750 MMBtus.

SWA has entered energy information about the Park Road Booster Station 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 8,751.1 kBtu/sq ft yr compared to the national average of a building consuming 104.0 kBtu/sq ft yr. The Site Energy Use Intensity appears extremely high due to the use of large pumping motors compared to a small floor area. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 17.9 kBtu/sqft yr, with an additional 29.6 kBtu/sq ft yr from the recommended ECMs and 3.1 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Implementing this report's recommendations will reduce use by approximately 50.6 kBtu/ft^{2}yr, which would decrease the building's energy use intensity to 8,700.5 kBtu/ft^{2}yr.

Recommendations

The Park Road Booster Station was originally built circa 1964 and was completely renovated in 2005. The building serves primarily as a booster station for the Water department. The building has two pumps with efficient motors that are operated with Variable Frequency Drives (VFDs). On average, the building sees water at a rate of 700 GPM for a total of approximately 1,000,000 gallons per day. Since the building was recently renovated and consists of newer, efficient equipment, SWA has recommended a package of measures that addresses lighting.

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 replacing them)

Category II Recommendations: Operations and Maintenance

- Maintain roofs
- Bi-annual inspections of roof surfaces
- Provide weather stripping / air sealing

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **1** Energy Conservation Measure (ECM) for the Park Road Booster Station that is summarized in the following Table 1. The total investment cost for this ECM with incentives is **$405**. SWA estimates a first year savings of **$220** with a simple payback of **1.8 years**. SWA also recommends **1** ECM with a 5-10 year payback that is summarized in Table 2 and **1** End of Life Cycle ECMs.

The implementation of all the recommended ECMs would reduce the building electric usage by 2,968 kWh annually, or 1% of the building's current electric consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Park Road Booster Station by **5,315 lbs of CO_2**, which is equivalent to avoiding the need of 12 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 $0.002/kWh, which would have equated to $1,026 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 up to 80% of the capital investment.

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 9 new CFL fixtures	RSMeans	405	0	405	1,051	0.2	0	17.9	55	220	5	1,002	1.8	147	30	46	597	1,882
	TOTALS		**405**	**0**	**405**	**1,051**	**0.2**	**0**	**17.9**	**55**	**220**	**-**	**1,002**	**1.8**	**-**	**-**	**-**	**597**	**1,882**

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 6 new Pulse Start Metal Halide fixtures	RSMeans	4,832	150	4,682	1,734	0.4	0	29.6	353	625	15	7,357	7.5	57	4	10	2,675	3,105
	TOTALS		**4,832**	**150**	**4,682**	**1,734**	**0.4**	**0**	**29.6**	**353**	**625**	**-**	**7,357**	**7.5**	**-**	**-**	**-**	**2,675**	**3,105**

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
3	Install 5 new T8 fluorescent fixtures	RS Means	1,077	150	927	183	0	0	3.1	23	52	15	609	17.9	-34	-2	-2	-318	328
	TOTALS		**1,077**	**150**	**927**	**183**	**0.0**	**0**	**3.1**	**23**	**52**	**-**	**609**	**17.9**	**-**	**-**	**-**	**-318**	**328**

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

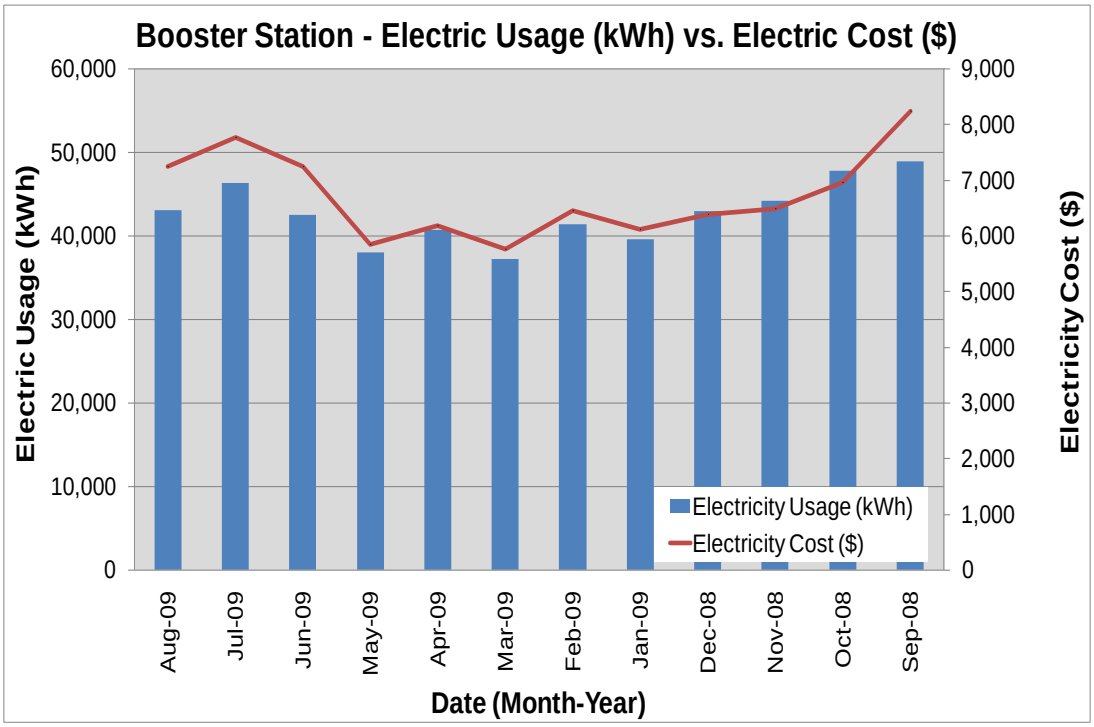
1. HISTORIC ENERGY CONSUMPTION

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 Park Road Booster Station with electric and natural gas.

Electricity - Park Road Booster Station buys electricity from JCP&L at **an average rate of $0.157/kWh** based on 12 months of utility bills from September 2008 to August 2009. The Park Road Booster Station purchased **approximately 512,960 kWh or $80,718 worth of electricity** in the previous year. The Park Road Booster Station is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **68.3 kW** and an annual peak demand of **74.8 kW**.

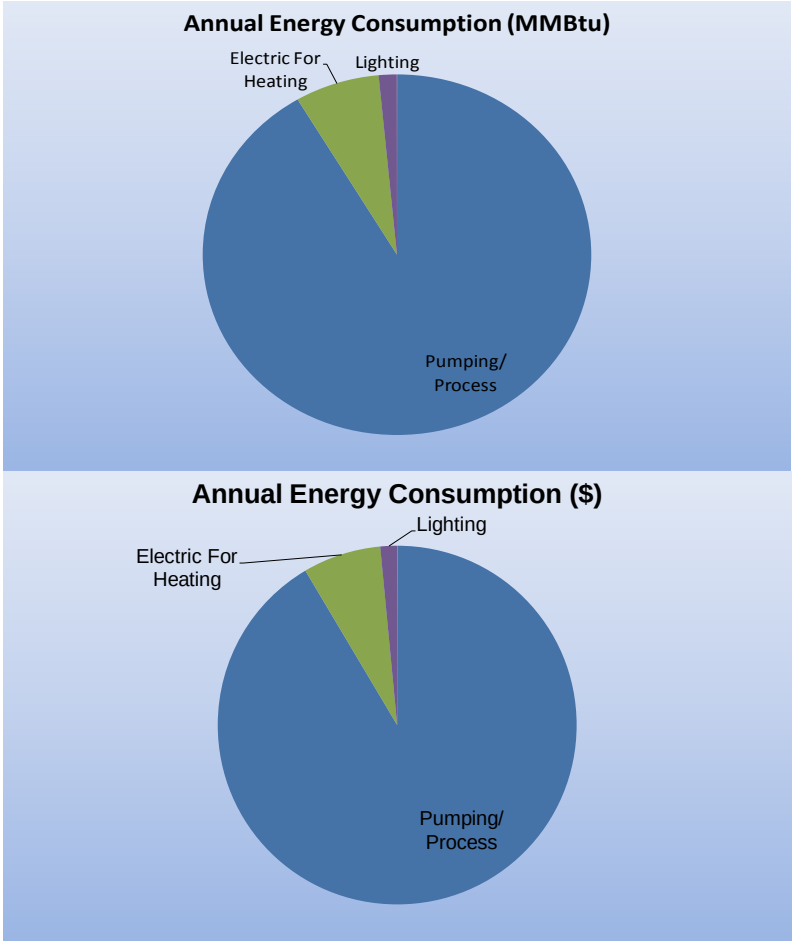
The following chart shows electricity use versus cost for the Park Road Booster Station based on utility bills for the 12 month period of September 2008 to August 2009.



Electricity use does not follow a trend as expected; there are very small peaks due to the large amount of electricity not being used for heating or cooling purposes and two separate peaks in the winter and summer that correspond to the use of electricity as the fuel source for the heating equipment and rise in cost during the summer for cooling. The cost of electricity fluctuates as expected with usage.

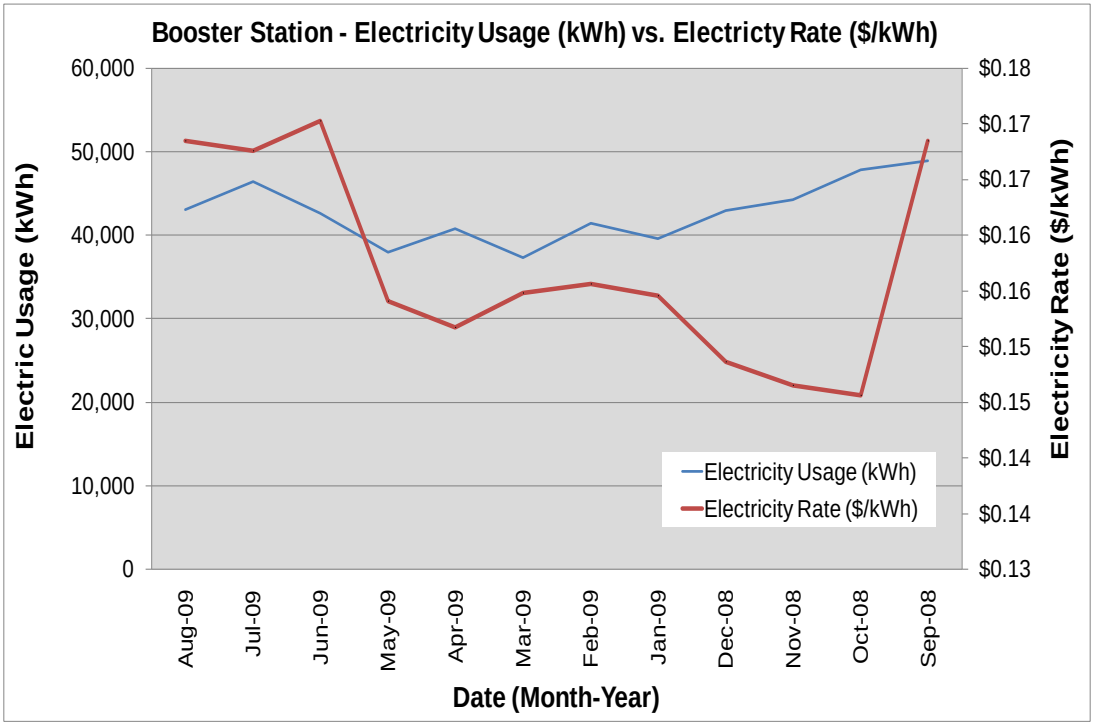
The following table and chart pies show energy use for the Park Road Booster Station based on utility bills for the 12 month period of September 2008 to August 2009.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Pumping/Process	1,622	93%	$74,646	93%	46
Electric For Heating	103	6%	$4,922	6%	46
Lighting	25	1%	$1,150	1%	46
Totals	1,750	100%	$80,718	100%	
Total Electric Usage	1,750	100%	$80,718	100%	46
Totals	1,750	100%	$80,718	100%	



1.2. Utility rate analysis

The Park Road Booster Station 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 Park Road Booster Station currently pays an average rate of approximately $0.157/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.



1.3. Energy benchmarking

SWA has entered energy information about the Park Road Booster Station 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 8,751.1 kBtu/sq ft yr compared to the national average of a building consuming 104 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 17.9 kBtu/sqft yr, with an additional 29.6 kBtu/sq ft yr from the recommended ECMs and 3.1 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
Booster Station

Building ID: 1978318
For 12-month Period Ending: August 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: December 30, 2009

Facility	Facility Owner	Primary Contact for this Facility
Booster Station Park Road Staten Island, NJ 07054	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): 200

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,750,220
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	1,750,220

Energy Intensity[5]	
Site (kBtu/ft²/yr)	8751
Source (kBtu/ft²/yr)	29229

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	267

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	13622%
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 Park Road Booster Station building located at Park Road was built circa 1964 and was recently upgraded in 2005. The Parsippany - Troy Hills Park Road Booster Station consists of approximately 200 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 a mechanical room with a focus on motors and pumps and also houses an unoccupied basement as well as the ground floor. 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 Park Road Booster Station. Most of the exterior wall surface is an 8” concrete block wall with stucco finish. There is also a small section with an exterior finish of 4” red masonry brick along corners and around windows and penetrations. Additionally, there is also a small portion with a vinyl siding exterior with the concrete wall to the interior.

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. 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.

Existing Roof Surface

2.3.2. Roof

The roof of the Park Road Booster Station is a flat roof that is slightly sloped for drainage. The surface of the roof is dark-grey asphalt shingles, 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 upgrades 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.

2.3.4. Windows

The existing windows of the Park Road Booster Station are operable double hung aluminum frame units that are double glazed with storm doors. 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 Park Road Booster Station 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

2.3.6. Building air tightness

Based on a visual inspection and communication with the building staff, the building was observed to be adequately 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 Park Road Booster Station is a building that contains pumps and motors and is not constantly occupied. The building contains two electric unit heaters that are used only to maintain a minimum temperature to prevent freezing within the booster station. The building does not contain a cooling system.

2.4.1. Heating

The Park Road Booster Station contains two Qmark electric unit heaters that provide convective heating to the building. These unit heaters each have thermostats that are always set to 55ºF, used to prevent freezing within the building. These unit heaters are rarely ever operational due to the fact that the pump motors generate enough heat to warm the building.

2.4.2. Cooling

The Park Road Booster Station does not contain a cooling system.

2.4.3. Ventilation

The building contains passive vents to allow fresh air into the building. On the roof, there are two exhaust fans that remove stale air from the building as well as induce fresh air through the passive vents. The manual exhaust fans are run minimally to remove stale air from the building.

2.4.4. Domestic Hot Water

The building is not occupied and therefore does not contain a domestic hot water system.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Park Road Booster Station contains mostly inefficient lighting. All lighting in the building uses incandescent fixtures that SWA recommends replacing with CFL's (Compact Fluorescent Light bulb) and 4' T12 fixture that SWA recommends replacing with T8 fixtures. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be 75W metal halide fixtures. SWA recommends replacing the halogen fixtures with 50W CFL's (Compact Fluorescent Light-bulb). The exterior lights are currently controlled by a timer.

2.5.2. Appliances

Due to the limited size of the building and limited occupancy, there are no appliances installed in the building.

2.5.3.Elevators

The Park Road Booster Station does not have any installed elevators.

2.5.4.Process and others electrical systems

The Park Road Booster station serves as a water booster station for the Township of Parsippany-Troy Hills. The booster station contains two pumps that each contains Variable Frequency Drive (VFD) controls. The building primarily always uses one pump and contains a second pump for 100% redundancy. The VFDs are typically operated at 65%-70%. Communication with building staff revealed that the building is responsible for boosting water from a mediate zone to a high zone. The pumps are operated 24 hours per day, 365 days per year and see an average of 700 GPM for a total of 1,000,000 gallons per day.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Date Installed	Estimated Remaining useful life %
Pumps	P-2; Pump Motor; Emerson, 150 HP, 1780 RPM, 60 Hz, Nema Nom. Efficiency 95.0%, controlled by VFD usually set to 65-70% speed, nameplate info was blank	Inside booster station, right side	Emerson, ID#K01 20033401-100R-01, Model #NA, Serial #NA	Electricity	Pumps	2005	50%
Pumps	P-1; Pump Motor; Emerson, 150 HP, 1780 RPM, 60 Hz, Nema Nom. Efficiency 95.0%, controlled by VFD usually set to 65-70% speed, nameplate info was blank	Inside booster station, left side	Emerson, ID#K01 20033401-100R-01, Model #NA, Serial #NA	Electricity	Pumps	2005	50%
Heating	Two (2) Qmark electric unit heaters, no nameplate data, set on thermostats for 55F	Inside booster station, hung from ceiling	Qmark, Model #NA, Serial #NA	Electricity	Well house	2005	67%
Generator	Cummings, Quietsite generator	Inside Booster Station	Cummings, Quietsite, Model #NA, Serial #NA	Diesel	Well house	2005	67%
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 Park Road Booster Station, 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 Department continue to maintain pumps well and always purchase the most efficient motors when possible. Booster stations and 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 are not allowing water to penetrate the envelope of the building.

- Bi-annual inspections of roof surfaces – SWA recommends inspecting the exterior surface of the building at least twice per year as part of a preventative maintenance plan. Inspections should focus on correcting areas that may be prone to leakage, inspecting transition areas, windows and exterior doors.

- 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.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install 9 new CFL fixtures
	Description of Recommended 5-10 Year Payback ECMs
2	Install 6 new Pulse Start Metal Halide fixtures
	Description of Recommended End of Life Cycle (>10 year payback) ECMs
3	Install 5 new T8 fixtures

ECM#1: *Install 9 new CFL fixtures*

Description:

The Park Road Booster Station contains 9 incandescent lights used for interior lighting. These lights should be replaced with Compact Fluorescent Lightbulbs (CFLs) that are capable of providing the same light quality with 2/3 less wattage. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $405
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 9 new CFL fixtures	RSMeans	405	0	405	1,051	0.2	0	17.9	55	220	5	1,002	1.8	147	30	46	597	1,882

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 6 new Pulse Start Metal Halide fixtures*

Description:

The Park Road Booster Station contains 6 Probe Start Metal Halide fixtures for exterior lighting. SWA recommends replacing these existing exterior fixtures with Pulse Start Metal Halides. Typically, Probe Start Metal Halides are installed with an excessive high wattage due to the fact they degrade overtime. Pulse Start Metal Halide fixtures can be installed at a lower wattage, provide a better quality light and also last much longer, saving on cost savings associated with bulb replacement. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $4,682
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
2	Install 6 new Pulse Start Metal Halide fixtures	RSMeans	4,832	150	4,682	1,734	0.4	0	29.6	353	625	15	7,357	7.5	57	4	10	2,675	3,105

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 Halides with Pulse Start ($25 per fixture)
Maximum incentive amount is $150.

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 5 new T8 fluorescent fixtures*

Description:

The Park Road Booster Station currently contains five (5) T12 fluorescent fixtures containing magnetic ballasts for general interior lighting purposes. SWA recommends replacing each one of these fixtures with a more efficient T8 fluorescent fixture containing electronic ballasts. Typically, T8 electronic fixtures will save 30% both power and energy consumption versus T12 magnetic fixtures. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $927
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 5 new T8 fluorescent fixtures	RS Means	1,077	150	927	183	0	0	3.1	23	52	15	609	17.9	-34	-2	-2	-318	328

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 – T-5 and T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity of lamps)
Maximum incentive amount is $150.

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

Solar Photovoltaic panels are not recommended since the building does not have available unobstructed areas with South-South West exposure.

5.4. Solar Thermal Collectors

Solar thermal collectors are not applicable to this building since there is no domestic hot water system.

5.5. Combined Heat and Power

CHP is not applicable for this building because of the size and limited heating system.

5.6. Geothermal

Geothermal is not applicable for this building because of the size and limited heating system.

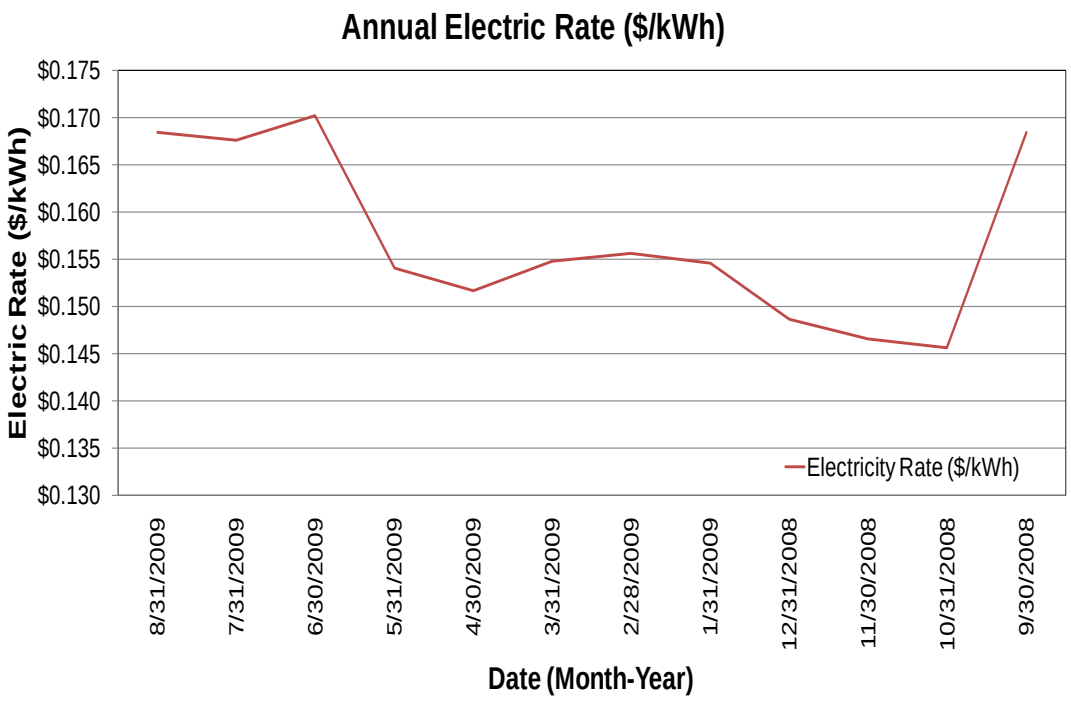
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

Currently there is not an ESCO engaged in the energy delivery 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 Park Road Booster Station from JCP&L without an ESCO. Electric bill analysis shows fluctuations of 15% over the 12 month period of September 2008 – August 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. Currently, the electricity rate for Park Road Booster Station is $0.157/kWh, which means there is a potential cost savings of $1,026 per year. 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 Park Road Booster Station. 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 Park Road Booster Station 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 Park Road Booster Station

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	GF	Mechanical Room	Parabolic	M	4'T12	5	2	40	S	4	365	15	415	694	T8	Parabolic	4'T8	E	S	5	2	32	4	365	6	326	511	183	0	183
2	GF	Mechanical Room	Screw-in	N	Inc	9	2	60	S	4	365	0	1,080	1,577	CFL	Screw-in	CFL	N	S	9	2	20	4	365	0	360	526	1,051	0	1,051
3	Ext	Exterior	Exterior	N	MH	6	2	75	T	12	365	38	938	4,941	PSMH	Exterior	PSMH	N	T	6	2	50	12	365	22	622	3,206	1,734	0	1,734
Totals:						20	6	175				53	2,433	7,211						20	6	102				1,308	4,243	2,968	0	2,968
Rows Highlighted 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 measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

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

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

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

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

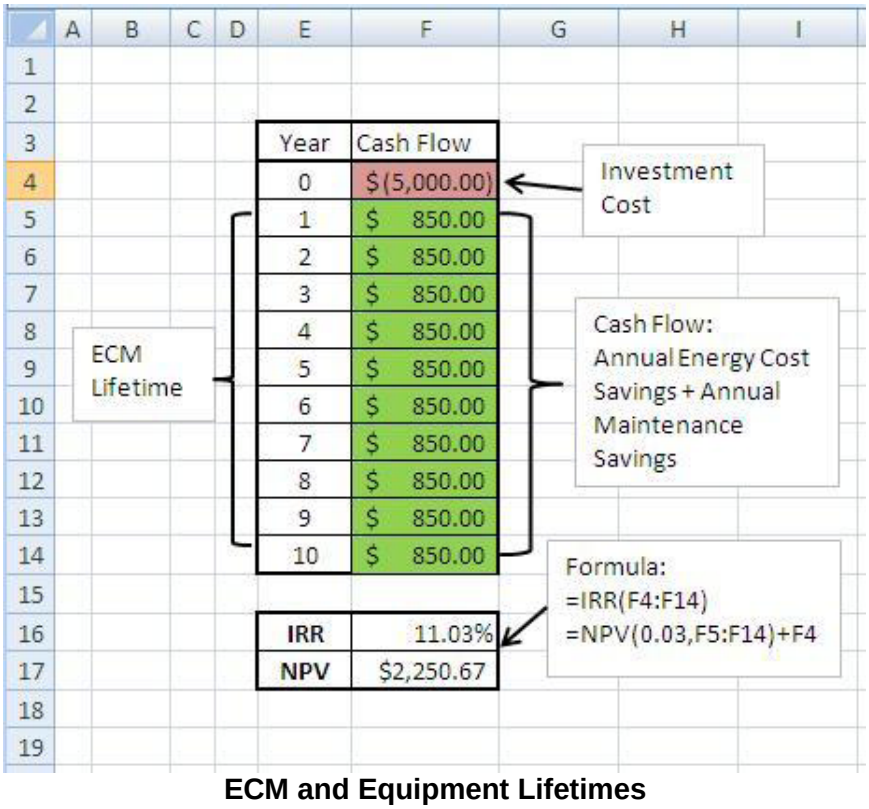
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime

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