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May 5, 2010

**Local Government Energy Program
Energy Audit Report**

For

***Township of Parsippany – Troy Hills
Parsippany – Troy Hills Department of Public Works
1 Pump House Road
Parsippany, NJ 07054***

Project Number: LGEA26



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INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Parsippany – Troy Hills buildings. The audit included a review of the Parsippany – Troy Hills Town Hall, Public Library, Community Center and Tennis Club, Police Headquarters, Parks Forestry and Recreation building, as well as the Water Utilities Office, DPW complex, 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 Department of Public Works Complex located at 1 Pump House Road, Parsippany, NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Parsippany - Troy Hills Department of Public Works Complex, located at 1 Pump House Road was opened in 1989, when work was completed as a new construction. The Parsippany - Troy Hills Department of Public Works consists of approximately 20,750 square feet of conditioned space with occupancy of approximately 16 employees per shift. The complex is home to two buildings; one for offices and workshops and the other is a 7-bay garage. The building is not open to the public and access is restricted to authorized personnel. It is open Monday through Friday 9:00 AM to 5:00 PM and weekends and nights as work project schedules, and overtime and emergency use dictate.

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

EXECUTIVE SUMMARY

The Parsippany - Troy Hills Department of Public Works Complex, located at 1 Pump House Road, is home to two buildings; the larger and newer building is used for offices and a garage and the other smaller and older building is used as a workshop, for storage and as an office space for the Office of Emergency Management (OEM). The larger building was opened in 1989 and the smaller building was built in 1935. The Parsippany - Troy Hills Department of Public Works Complex consists of a total approximate size of 20,750 square feet of conditioned space with total occupancy of 70 employees, with as many as 25-30 employees in the building at once during lunch time.. The buildings are not open to the public and access is restricted to authorized personnel.

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 August 2008 through July 2009, the period of analysis for this audit, the buildings consumed 209,148 kWh or \$37,749 worth of electricity at an approximate rate of \$0.180/kWh and 11,365 therms or \$15,628 worth of natural gas at an approximate rate of \$1.375 per therm. The joint energy consumption for the buildings, including both electricity and fossil fuel was 1,850 MMBtus of energy that cost a total of \$53,377.

SWA has entered energy information about the Department of Public Works in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the buildings are not eligible to receive a performance rating due to their 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 89.0 kBtu/sq ft yr compared to the national average of vehicle service buildings consuming 77.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 1.4 kBtu/sqft yr, with an additional 2.4 kBtu/sq ft yr from the recommended ECMs and 4.5 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Recommendations

Implementing this report's recommendations will reduce use by approximately 8.3 kBtu/ft²yr, which would decrease the building's energy use intensity to 80.7 kBtu/ft²yr.

The Department of Public Works facility consists of two buildings with varying equipment. The structure was built in 1989 and most of the original equipment that is left has approached or is approaching the end of its useful lifetime. SWA recommends a package of measures that address lighting, HVAC systems as well as HVAC controls and introduces renewable energy in the form of Solar Photovoltaic panels.

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

- Install slab perimeter insulation
- Upgrade existing single pane windows

Category II Recommendations: Operations and Maintenance

- Re-configure BMS settings on smaller building
- Re-connect garage unit heaters to garage doors
- Reset temperature on thermostat of UH-3 in larger garage
- Remove window AC unit seasonally
- Bi-annual inspections of exterior walls
- Bi-annual inspections of roof
- Bi-annual inspections of windows and exterior doors
- 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 a total of **3** Energy Conservation Measures (ECMs) for the Department of Public Works Complex that is summarized in the following Table 1. The total investment cost for these ECMs with incentives is **\$5,550**. SWA estimates a first year savings of **\$1,294** with a simple payback of **4.3 years**. SWA also recommends **2** ECMs with a 5-10 year payback that is summarized in Table 2 and **4** End of Life Cycle ECMs.

The implementation of all the recommended ECMs would reduce the buildings' electric usage by 21,425 kWh annually, or 10% of the buildings' current electric consumption. The implementation of all the recommended ECMs would also reduce the building natural gas usage by 994 therms annually, or 9% of the building's current natural gas consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Department of Public Works by **49,318 lbs of CO₂**, which is equivalent to removing approximately 3 cars from the roads each year or avoiding the need of 118 trees to absorb the annual CO₂ 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 \$0.029/kWh, which would have equated to \$6,065 for the past 12 months.

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

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

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs

ECM #	ECM description	Source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
1	Install programmable thermostat in smaller building office area	RSMeans	200	0	200	215	0.0	63	0.3	0	125	10	1,058	1.6	429.1	42.9	62.2	858	1,079
2	Install 5 new Occupancy Sensors	RSMeans	1,100	100	1,000	1,691	0.4	0	0.3	0	304	10	2,570	3.3	157.0	15.7	27.8	1,570	3,028
3	Install 25 new CFL lamps	RSMeans	4,350	0	4,350	4,698	1.0	0	0.8	19	865	5	3,937	5.0	-9.5	-1.9	14.9	2,951	8,412
TOTALS			5,650	100	5,550	6,604	1.4	63	1.4	19	1,294	-	7,566	4.3	-	-	-	5,379	12,519

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
4	Install 10kW Solar PV array on Garage roof	Similar Project	70,000	10,000	60,000	11,804	10.0	0	1.9	0	8,725	25	148,594	6.9	147.7	5.9	12.5	53,849	21,135
5	Install 8 new Pulse Start Metal Halide fixtures	RSMeans	6,442	200	6,242	3,031	0.6	0	0.5	213	759	15	8,926	8.2	43.0	2.9	8.7	2,684	5,427
	TOTALS		76,442	10,200	66,242	14,835	10.6	0	2.4	213	9,483	-	157,520	7.0	-	-	-	56,534	26,562

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
6	Remove cast iron radiator and replace with convective unit heater in smaller building garage	RSMeans	3,623	0	3,623	-56	0	121	0.6	30	186	25	3,173	19.4	-12.4	-0.5	2.0	-450	1,234
7	Replace 440 MBH boiler in smaller building with high efficiency unit	RSMeans	22,500	770	21,730	0	0	520	2.5	200	915	25	15,584	23.7	-28.3	-1.1	0.4	-6,146	5,732
8	Replace 199 MBH boiler in larger building with high efficiency unit	RSMeans	11,765	300	11,465	0	0	214	1.0	60	354	25	6,033	32.4	-47.4	-1.9	-1.9	-5,432	2,359
9	Replace unit heater in lounge area of smaller building and connect to HW loop	RSMeans	4,823	0	4,823	42	0	76	0.4	30	142	25	2,419	34.0	-49.8	-2.0	-2.2	-2,404	913
TOTALS			42,711	1,070	41,641	-14	0.0	931	4.5	320	1,598	-	27,209	26.1	-	-	-	-14,432	10,237

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

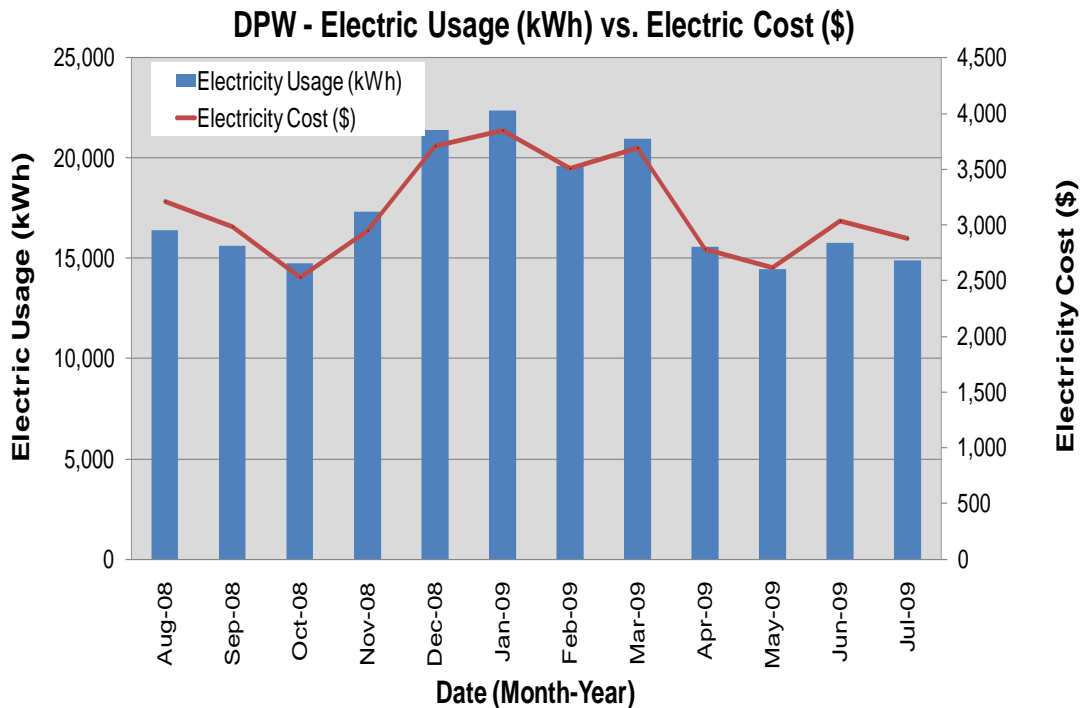
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **August 2008 through July 2009** (period of analysis) that were received from the utility companies supplying the Department of Public Works with electric and natural gas.

Electricity - The Department of Public Works buys electricity from JCP&L at an **average rate of \$0.180/kWh** based on 12 months of utility bills from August 2008 to July 2009. The Department of Public Works purchased **approximately 209,148 kWh or \$37,749 worth of electricity** in the previous year. The Department of Public Works is currently charged for demand (kW) which has been factored into each monthly bill. The building had an annual peak demand of **50.5 kW** and an average monthly demand of **26.4 kW**.

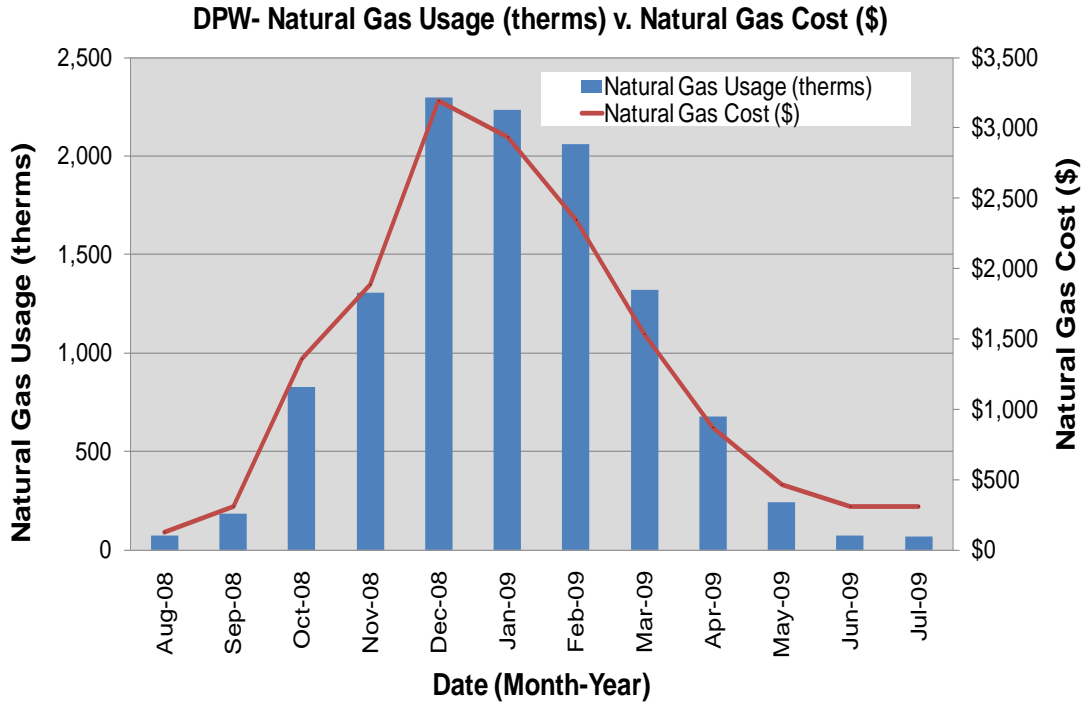
Natural gas - The Department of Public Works is currently served by one meter for natural gas. The Department of Public Works currently buys natural gas from New Jersey Natural Gas (NJNG) at an **average aggregated rate of \$1.375/therm** based on 12 months of utility bills for August 2008 to July 2009. The Department of Public Works purchased **approximately 11,365 therms or \$15,628 worth of natural gas** in the previous year.

The following chart shows electricity use versus cost for the Department of Public Works based on utility bills for the 12 month period of August 2008 to July 2009.



Electricity use follows an unusual but expected trend; peaking during the summer months when air conditioning units are used most and in the winter due to the use of electricity as a heating fuel energy source. The cost of electricity fluctuates as expected with usage.

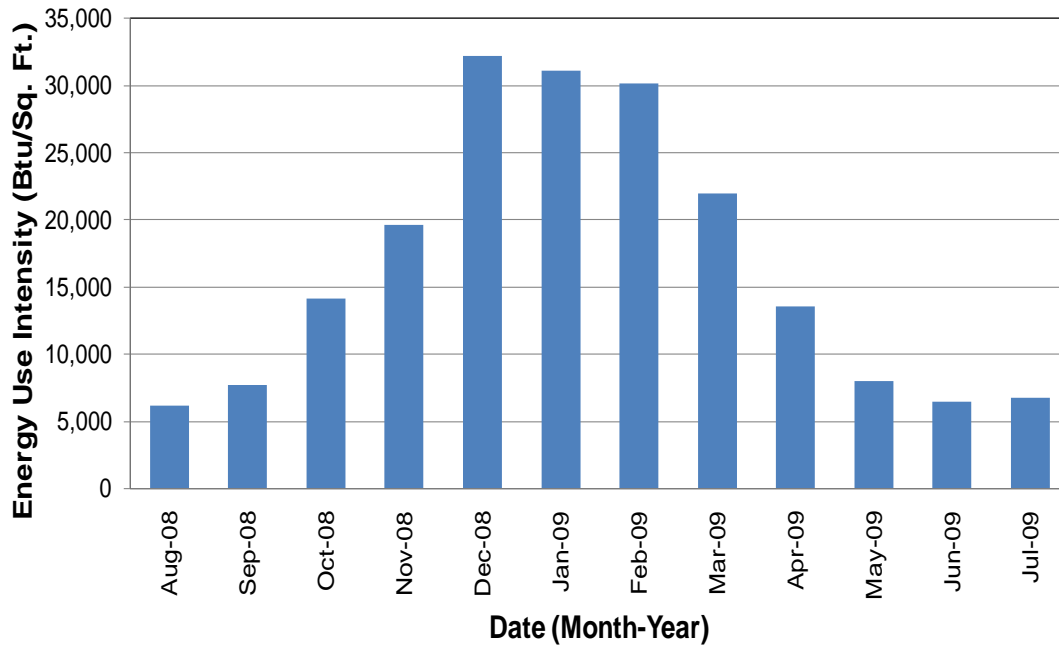
The following is a chart of the natural gas annual load profile for the building versus natural gas costs, peaking in the coldest months of the year.



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

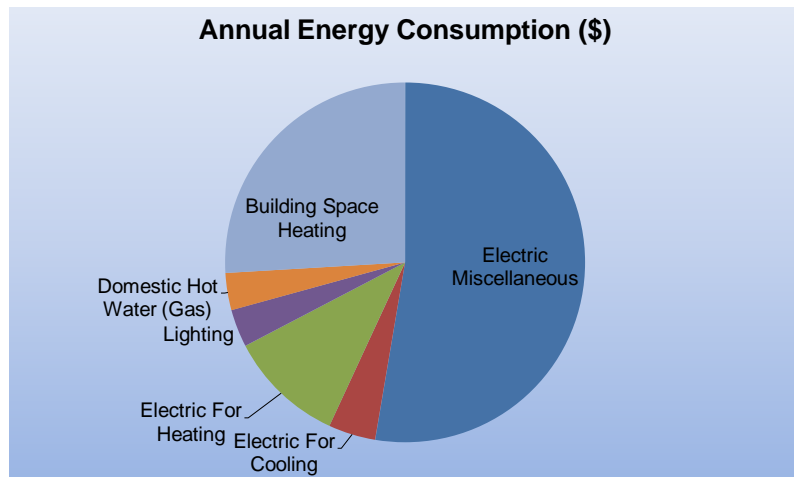
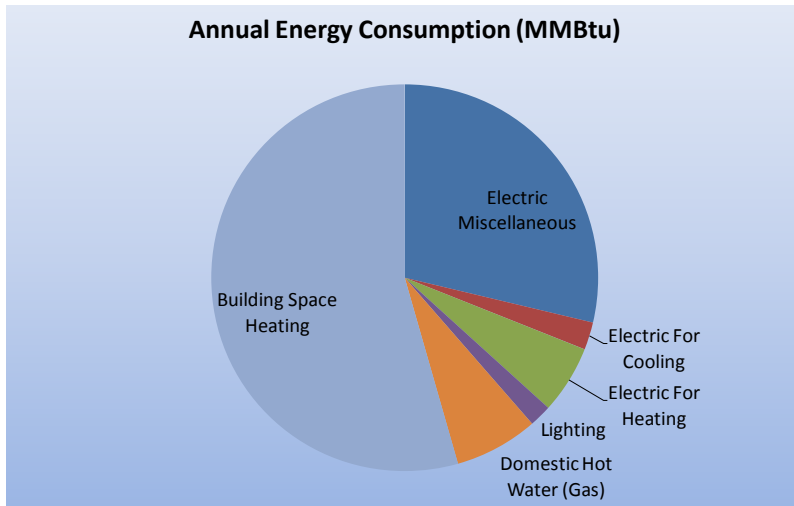
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the building based on utility bills for the 12 month period of August 2008 to July 2009.

DPW - Energy Use Intensity (Btu/Sq. Ft.)



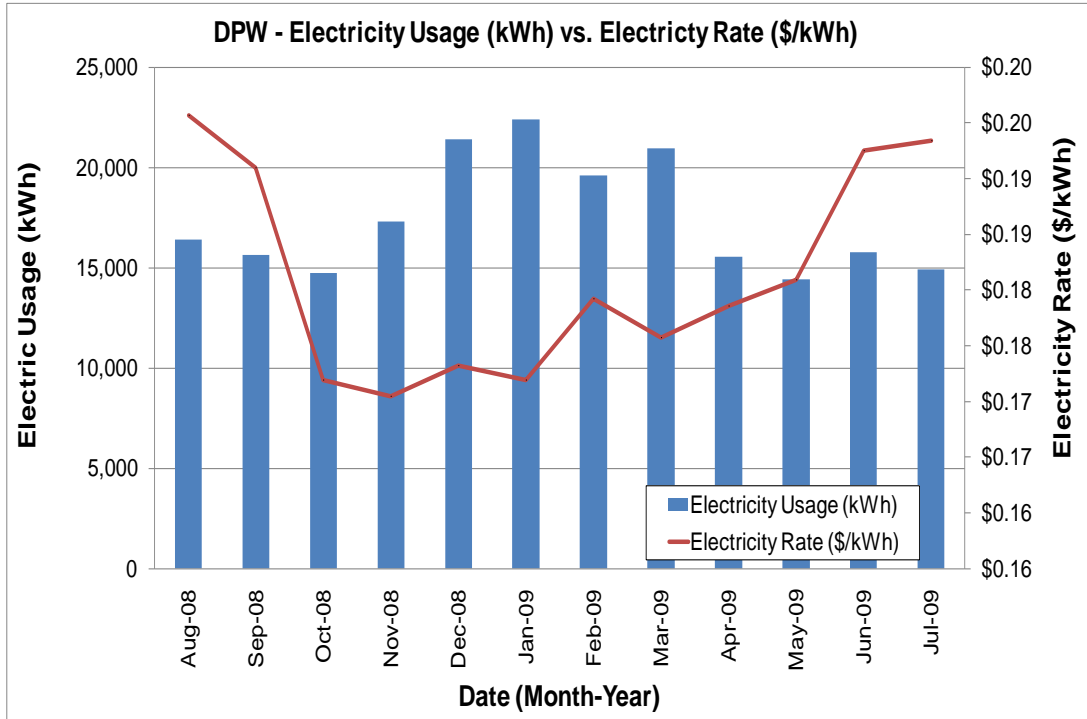
The following table and chart pies show energy use for the Department of Public Works based on utility bills for the 12 month period of August 2008 to July 2009. Note electrical cost at \$53/MMBtu of energy is more than 3.5 times as expensive to use as natural gas at \$14/MMBtu.

Aug. 2008 - July 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	441	24%	\$23,331	44%	53
Electric For Cooling	43	2%	\$2,259	4%	53
Electric For Heating	105	6%	\$5,572	10%	53
Lighting	125	7%	\$6,586	12%	53
Domestic Hot Water (Gas)	129	7%	\$1,778	3%	14
Building Space Heating	1,007	54%	\$13,850	26%	14
Totals	1,850	100%	\$53,376	100%	
Total Electric Usage	714	39%	\$37,749	71%	53
Total Gas Usage	1,136	61%	\$15,628	29%	14
Totals	1,850	100%	\$53,376	100%	

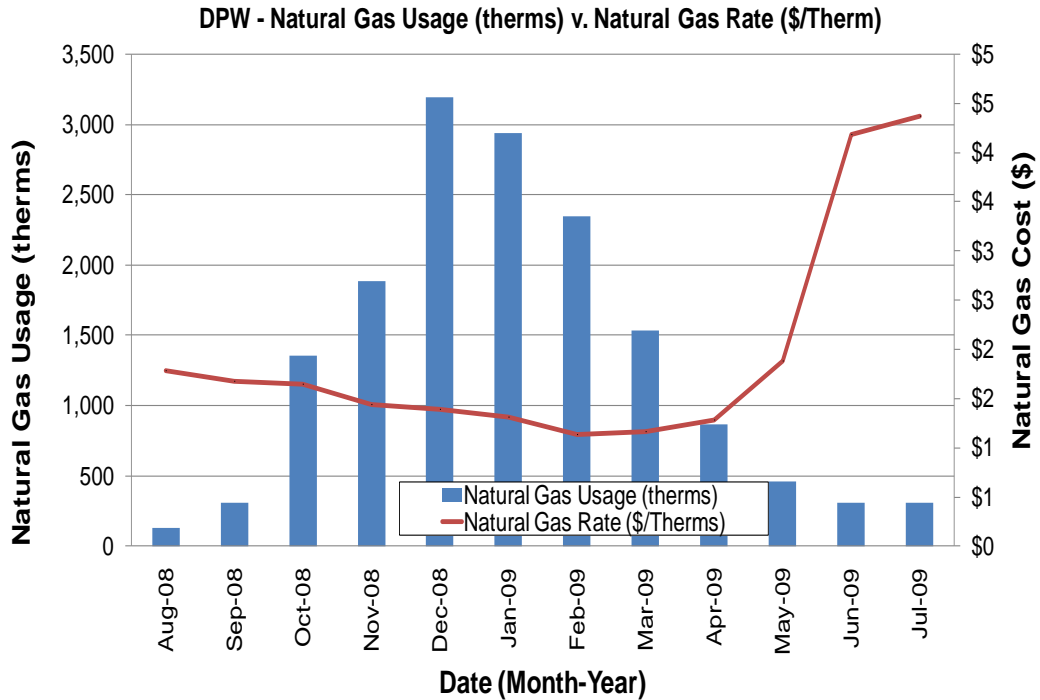


1.2. Utility rate analysis

The Department of Public Works 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 Department of Public Works currently pays an average rate of approximately \$0.180/kWh based on the 12 months of utility bills of August 2008 to July 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 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 Department of Public Works 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 Department of Public Works currently. The average aggregated rate (supply and transport) for the meter is approximately \$1.375/therm based on 12 months of utility bills for August 2008 to July 2009. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Department of Public Works billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boilers. The high gas price per therm fluctuations in the summer may also be from the building paying for fixed costs such as meter reading charges during the summer months.



1.3. Energy benchmarking

SWA has entered energy information about the Department of Public Works 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 89.0 kBtu/sq ft yr compared to the national average of vehicle service buildings consuming 77.0 kBtu/sq ft yr. Implementing this report’s highly recommended Energy Conservation Measures (ECMs) will reduce use by approximately 1.4 kBtu/sqft yr, with an additional 2.4 kBtu/sq ft yr from the recommended ECMs and 4.5 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.

STATEMENT OF ENERGY PERFORMANCE

Parsippany - DPW

Building ID: 1970942
For 12-month Period Ending: July 31, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: February 10, 2010

Facility Parsippany - DPW 1 Pump House Road Parsippany, NJ 07054	Facility Owner N/A	Primary Contact for this Facility N/A
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Year Built: 1989
Gross Floor Area (ft²): 20,750

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	713,613
Natural Gas (kBtu) ⁴	1,136,597
Total Energy (kBtu)	1,850,210

Energy Intensity⁵

Site (kBtu/ft ² /yr)	89
Source (kBtu/ft ² /yr)	172

Emissions (based on site energy use)

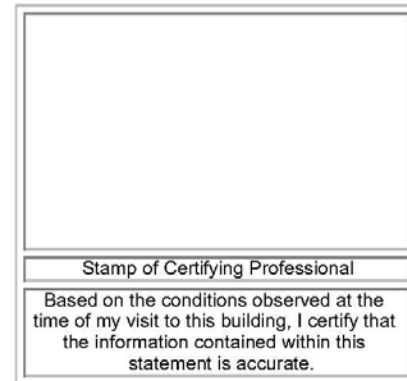
Greenhouse Gas Emissions (MtCO ₂ e/year)	169
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Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	15%
Building Type	Service (Vehicle Repair/Service, Postal Service)



Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional
N/A

Notes:

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

The government estimates the average time needed to fill out this form is 5 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Parsippany - Troy Hills Department of Public Works Complex, located at 1 Pump House Road, is home to two buildings; the larger and newer building is used for offices and a garage and the other smaller and older building is used as a workshop, for storage and as an office space for the Office of Emergency Management (OEM). The larger building was opened in 1989 and the smaller building was built in 1935. The Parsippany - Troy Hills Department of Public Works Complex consists of a total approximate size of 20,750 square feet of conditioned space with a total occupancy of approximately 870 employees with as many as 25-30 employees in the building at once for lunch time.. The buildings are not open to the public and access is restricted to authorized personnel.

2.2. Building occupancy profiles

There are approximately 75 full time employees at the Department of Public Works and occupancy will not increase since the building is not open to the public and access is restricted to authorized personnel. It is open Monday to Friday 6:00 AM to 4:30 PM, Saturday 8:00 AM to 12:00PM and on weekends and nights as work project schedules, and overtime and emergency use dictate.

2.3. Building envelope

2.3.1.Exterior Walls

There are three typical types of exterior walls at the Department of Public Works. At the office and portions of the building the exterior wall is constructed of red masonry brick, at the garages the exterior wall is constructed of aluminum sides over concrete masonry units. Additionally there is a large portion of the rear of the office buildings that is under construction and is currently composed of exterior-grade plywood and prefabricated insulated foam block.



Existing Exterior Walls



Rear Wall under Construction

Overall, exterior and interior wall finishes of the envelope that were not under construction were found to be in age-appropriate, adequate condition with no major signs of water or air leakage. There were some isolated instances at surface transitions, building corners, and seams that are beginning to show signs of cracking and other damage as well as some cracked masonry that also seems to have been shifted. 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.



Instances of Damaged Masonry Units

2.3.2. Roof

There are two different roof systems at the Department of Public Works Complex. The roof above the office building is a pitched asphalt shingled roof with fiberglass blanket insulation and wooden roof framing. The roof above the garage is constructed of corrugated metal roofing and fiberglass blanket insulation layer to the interior. There are a few isolated instances where the shingles show signs of damage or displacement and should be replaced immediately. Given the age of the building, there are no improvements to the roof assembly or insulation that would provide a significant improvement to the building performance; however, SWA does recommend biannual maintenance inspections with a focus on the drainage, penetrations, flashing and seams of the roof.



Existing Roof above the Office Building



Existing Roof above the Garage

2.3.3.Base

The office building's base is 4" concrete slab-on-grade with vapor barrier and porous fill and the base of the garage is a 6" concrete slab-on-grade with vapor barrier and porous fill. There were no reported problems with water penetration or moisture; however, there are portions of the office and garage bases that are beginning to show signs of cracking and damage. 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.



Cracked Building Base

2.3.4.Windows

The existing windows of the Department of Public Works are typically wooden framed vinyl clad single paned units that are double hung and operable with storm doors. There are also fixed inoperable aluminum framed casement units with grills.

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. Most of the windows appear to be in good age-appropriate condition; however, some of the units are beginning to show signs of cracking around the frames.



Typical Window installation

2.3.5.Exterior doors

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

2.3.6.Building air tightness

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

2.4. HVAC Systems

The Department of Public Works contains two separate building and therefore has two separate HVAC systems. The smaller building contains a boiler that provides hot water heat to unit heaters in the garage, a unit heater and baseboard heaters in office areas as well as cast iron radiators in the garage. The building uses split system AC units as well as window units to cool the office areas. The Department of Public Works larger building contains a boiler that provides hot water to two air handling units for the office areas. The garage areas are heated using individual, gas-fired unit heaters. The larger DPW building also contains a split cooling system for the office areas.

2.4.1.Heating

The smaller DPW building is operated from the BMS system centralized at the Town Hall building and contains one Weil McLain boiler with an input capacity of 440 MBH and 80% thermal efficiency. This boiler provides heating hot water to a unit heater and baseboard heaters located in the office area as well as several unit heaters and a cast iron radiator, located in the garage area. The garage area of this building is heated using unit heaters that are connected to the hot water loop from the boiler. There is one small lounge area in the back of the garage that is heated using a Reznor gas-fired unit heater. The smaller portion of the building contains older equipment that is beginning to reach the end of its useful lifetime. SWA recommends replacing the existing boiler to a newer boiler, which should have an efficiency of at least 85%. SWA was informed that the building is connected to the Main BMS system but may not be controlled correctly. On the day of the site visit, the outside temperature was temperate and heating was turned up above 75F in the office areas. Since the office was unoccupied but calling for additional heat, the boiler was forced to turn on unnecessarily. SWA recommends that the BMS system is configured to cutoff the boiler when the outside temperature reaches above 55F. It was also noted by building staff that the boiler is usually allowed to run 24 hours per day. SWA recommends configuring the BMS system to setback to a low temperature at night, unless it is manually over-ridden in the case of extended hours of work. In addition to the boiler recommendation, SWA recommends removing the cast iron radiator and replacing it with a ceiling-hung unit heater attached to the hot water loop. Currently, the cast-iron radiator is located against the wall of the garage and provides a low quality heat that is not distributed evenly throughout the garage. SWA recommends installing a convective unit heater that provides an equivalent output of heat, is hung from the ceiling and will warm the garage evenly with the use of a fan and convective heat. SWA also recommends replacing the gas-fired unit heater in the lounge area with a new unit

heater that is connected to the hot water loop. This measure will require new hot water piping but will ultimately reduce the cost of heating the building by using hot water that is already created by the boiler instead of requiring the unit to fire separately. On the day of the field visit, SWA also observed that no staff members were occupying the building but the heat was turned to 75F. The day of the site visit was a warm day and did not require heat. It was clear that someone had left the thermostat set high, which was allowing the boiler to fire unnecessarily to heat the office space. SWA recommends replacing the existing thermostat with a programmable thermostat that reduces the set point temperature of the system when the building is not occupied as well as at night.

The larger DPW building is controlled by a separate BMS system unique to the building and contains one Weil McLain boiler with an output heating capacity of 199 MBH and 80% thermal efficiency. This unit provides hot water heating to two air handlers within the office portion of the building that distribute conditioned air throughout the office areas. SWA recommends replacing the existing boiler with a newer, more efficient boiler with a minimum thermal efficiency of 85%.

The larger DPW garage is heated using eight individual, gas-fired unit heaters. These unit heaters were connected to a control switch on the garage doors so that the unit heaters were not allowed to fire when garage doors were open. According to building staff, this function was disabled by employees. SWA recommends that this feature is re-connected so that unit heaters are not allowed to run when the garage doors are open, allowing expensive, conditioned air to leak out of the building.

2.4.2.Cooling

The smaller DPW building only contains cooling for the office areas. The office areas are cooled using one split AC system as well as a single window unit. Both the window AC unit and split AC system were observed in good condition and would not benefit from upgrading at this point in time. According to building staff, the window AC unit is not removed during winter months and is not covered properly. SWA recommends that building staff remove this unit at the end of each cooling season in order to allow the window to shut and the building to be sealed properly.

The larger DPW building also contains cooling for the office areas and not the garage areas. Cooling is provided from the two Trane air handling units located in the ceiling above the office areas. These units are connected to condensers located outside of the building, providing cooled air via R-22 refrigerant.

2.4.3.Ventilation

As mentioned above, the office area of the small building is ventilated using a split-ac system as well as natural ventilation with operable windows. The larger building office area is ventilated by the two air handlers located in the plenum of the ceiling above the office area. Garage areas contain exhaust fans to reduce exhaust air as well as fumes from the garage space.

In addition to the air handling unit, each garage area contains an independent air cleaning system that removes exhaust from the air and introduces fresh air. Each building also uses exhaust fans to rid the building of stale air and induce fresh air into the building.

2.4.4.Domestic Hot Water

There is one Rheem atmospheric, gas-fired hot water heater with approximately 100 gallons storage installed in the larger DPW building. This unit provides domestic hot water (DHW) for the entire building. This domestic hot water heater was observed to be appropriately sized and in good

condition. The smaller DPW building has one bathroom that uses a small 5-gallon electric heater for domestic hot water. Due to the small DHW load, SWA does not recommend upgrading this heater to natural gas at this point in time.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The Department of Public Works contains mostly efficient lighting. All lighting in the building uses 2’ 4’ or 8’ T8 fixtures with electronic ballasts, CFL’s (Compact Fluorescent Lamp) or Halogen light bulbs. SWA recommends replacing the halogen HID light bulbs with CFL’s as well as installing 5 occupancy sensors throughout the building to limit the amount of runtime of certain fixtures. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

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

Exterior Lighting - The exterior lighting surveyed during the building audit were found to be mostly 250W metal halide fixtures and 100W halogen fixtures. SWA recommends replacing those fixtures with 175W and 65W pulse start metal halide lamps respectively.

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Parsippany - Troy Hills Department of Public Works Complex and has determined that it would not be cost-effective to replace the appliances at this given time. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the “Products” section of the Energy Star website at: <http://www.energystar.gov>.

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

2.5.3. Elevators

The Department of Public Works does not have any installed elevators.

2.5.4. Process and others electrical systems

There are currently no other electrical systems installed in the building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Date Installed	Estimated Remaining useful life %
Heating	Qmark unit heater, MUH072	Smaller building, above safe, ceiling hung	Qmark, Model #MUH072, Serial #NA	Hot Water Loop	Smaller building, Office area	2003	33%
Cooling	Window unit left in during winter, no nameplate info available	Smaller building, front window	Make NA, Model #NA, Serial #NA	Electricity	Smaller building, Office area	2004	40%
Cooling	HEIL Condenser 197V, 1/8 HP	Smaller building	HEIL, Model #CA7024QKA1, Serial# L913291297, Manufacturer #NCA7024QKA1	Electricity	Smaller building, Office area	2000	20%
Cooling	Emerson 115V, 60Hz, 6,000 Btu/hr, 15A, evaporator	Smaller building	Emerson, Model #6TF7A-E, Serial #OD25106	Electricity	Smaller building, Office area	2000	20%
Heating	Weil McLain, EGH Boiler, 550,000 Btuh Input, 440,000 Btuh Output, 80% Eff.	Smaller building	Weil McLain, Model #EGH-125-PIN, Serial #4NG	Natural Gas	Smaller building, Garage	1989	16%
Heating	Hot Water pumps Bell and Gossett 1/12 HP	Smaller building	Bell & Gosset	Electricity	Smaller building, Garage	2002	30%
Heating	Reznor convector heating unit heater, 60,000 Btuh input, 45,000 Btuh output, 75% thermal efficiency	Smaller building, back of building, lounge area	Reznor, Model #XL60-3, Serial #AMA31G8N00864	Natural Gas/Hot Water Loop	Smaller building, Garage lounge area	1998	30%
Heating	Honeywell, non-programmable thermostat	Smaller building, office area	Honeywell, Model #NA, Serial #NA	Electricity	Smaller building, office area	1989	10%
Heating	Weil McLain boiler; Input 244,000 Btuh, DOE Heating Capacity 199,000 Btuh, 80% Eff.	Larger building, Mechanical room through offices	Weil McLain, PFG Boiler, Model #PFG-5-PION, Serial #5	Electricity	Larger building, All areas	1989	16%
Heating	Hot Water Circulation Pump, Taco, 1/8 HP, 1725 RPM	Larger building, Garage	Taco, Model# SA55JXFSN-3748	Electricity	Larger building, All areas	2002	30%
Filtration	Ten (10) Airmation Air Cleaners	Larger building, Garage	Airmation, Model #NA, Serial #NA	Electricity	Larger building, Garage	1989	30%
Cooling	Two (2) Trane air handling units, 3 tons, R22 cooling, hot water loop	Ceiling of office areas	Trane, Series M3, Model #6PM-EO156AA10000, Serial #NA	Electricity / Hot Water Loop	Larger building, office areas	1989	20%
Domestic Hot Water	Rheem, Fury, atmospheric DHW heater, 100 gallons storage capacity, heating capacity NA	Garage	Rheem, Fury, Model #NA, Serial #NA	Natural Gas	Larger building, all areas	2002	30%
Heating	Eight (8) Trane unit heaters, identical models, 150,000 BTUH output, 115,500 BTUH input, 2000 CFM, 77% thermal efficiency, nameplate info taken from drawings	Larger building, Garage ceiling	Trane, Model #CPNC015AAA 3000D, Serial #NA	Natural Gas	Larger building, Garage	1989	10%
Heating/ Cooling	Two (2) Trane air handling units, no nameplate info available	Ceiling of office areas	Trane, Model #NA, Serial #NA	Electricity / Hot Water Loop	Larger building, office areas	1989	20%

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 Department of Public Works, 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

- Install slab perimeter insulation – If excavation work is required in the future for other reasons, SWA recommends that slab perimeter insulation is added to the existing slabs of both buildings. SWA recommends a minimum of 2 inches of rigid foam board insulation to help thermally protect the slab at the older building. This concrete floor shows some signs of cracking and damage. This measure is recommended as a capital improvement measure since the savings alone would not justify the installed cost.
- Upgrade existing single pane windows – The existing windows are single-paned, wooden-framed, vinyl clad windows with no effective low-e coating. SWA recommends that new windows are considered as part of a capital improvement plan. If major renovations of the exterior façade are required in the future, new, more energy efficient windows should be recommended. SWA recommends installing double-paned glass windows with an insulated frame that contains a thermal break. The glass should also contain a low-e coating to minimize the amount of heat that is allowed to enter the building through solar irradiation.

Category II Recommendations: Operations and Maintenance

- Re-configure BMS settings on smaller building – Currently the heating system in the smaller building is controlled by the Town Hall BMS system. Building staff informed SWA that although the boiler is controlled remotely by the main BMS system, it is allowed to run 24 hours per day at indicating that it is not setback properly. Also, the day of the site visit was a moderately warm day and the baseboard units in the office area were firing. The thermostat in the office area was set past 75F, forcing the boiler to come on and produce heat unnecessarily. The BMS controls should be configured to setback the temperature at night as well as set a cut off temperature of 55F so the boiler is not allowed to fire on warmer days.
- Re-connect garage unit heaters to garage doors - The unit heaters in the larger DPW garage were at one point connected to the garage doors, so that the unit heaters were not allowed to run when garage doors were open. According to building staff interviews, this function has been disconnected by employees. Connecting unit heaters to the garage doors reduces energy by not allowing garage works to heat the garage while the doors are open, allowing expensive, conditioned air to escape.
- Reset temperature on thermostat of UH-3 in larger garage – Unit heater #3 was currently firing on the day of the site visit because the thermostat had been adjusted. SWA recommends that this thermostat is reset back to original settings so that it is not used unnecessarily when building loads do not require heat.
- Remove window AC unit seasonally – SWA recommends that at the end of each cooling season, the window AC unit installed in the smaller building, office window is removed in order to allow the window to shut and seal the building properly. Window AC units do not provide proper thermal protection when left in windows all year long and additionally will begin to deteriorate over time when subjected to winter weather conditions.

- Bi-annual inspections of exterior walls – SWA recommends that the exterior wall constructions are inspected on a bi-annual basis as part of a routine maintenance plan. The inspections should have a focus on cracks, re-pointing of masonry, degraded caulking and locating sources of water and air leakage. There should be an increased focus on surface transitions.
- Bi-annual inspections of roof – SWA recommends that all roof surfaces are inspected on a bi-annual basis. Currently, there are some areas of the shingled roof that have damaged or displace shingles that should be repaired immediately. SWA recommends that inspections focus on drainage, surface penetrations, flashing and seams of the roof.
- Bi-annual inspections of windows and exterior doors – SWA recommend inspecting each window and door at least every 6 months as part of a preventative maintenance plan. Any air or water leakage should be corrected. Building staff should ensure that caulking and weather-stripping remain in tact to prevent energy losses.
- 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 programmable thermostat in smaller building office area
2	Install 5 new occupancy sensors
3	Install 25 new CFL lamps
	Description of Recommended 5-10 Year Payback ECMs
4	Install 10kW Solar PV array on Garage roof
5	Install 8 new Pulse Start Metal Halide fixtures
	Description of Recommended End of Life Cycle ECMs
6	Remove cast iron radiator and replace with convective unit heater in smaller building garage
7	Replace 440 MBH boiler in smaller building with high efficiency unit
8	Replace 199 MBH boiler in larger building with high efficiency unit
9	Replace unit heater in lounge area of smaller building and connect to HW loop

ECM#1: Install programmable thermostat in smaller building office area

Description:

The Department of Public Works – Smaller building currently contains 1 non-programmable thermostat in the office area. On the day of the site visit, this thermostat was set to over 75F on a seasonably warm day with no occupancy in the office. SWA recommends replacing this thermostat with a programmable thermostat that can be programmed to set back temperatures when the office is not in use. It was clear that this room is always left heated excessively 24 hours per day.

Installation cost:

Estimated installed cost: \$200
 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 programmable thermostat in smaller building office area	RS Means	200	0	200	215	0.0	63	0.3	0	125	10	1,058	1.6	429	43	62	858	1,079

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes that this unit is left heated to 75F for the entire heating season with no night time setback. Calculations are based on setting the temperature back at night to 60F and during the day to 70F.

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 5 new Occupancy Sensors

Description:

Based on field observations, there are 5 areas within the Department of Public Works facility that would benefit from occupancy sensors. These areas consist of office areas, lounge/lunch areas and other areas that are occupied infrequently. SWA recommends that these 5 areas are upgraded to occupancy sensors in order to reduce the amount of runtime based on occupancy schedules. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$1,000

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 5 new Occupancy Sensors	RS Means	1,100	100	1,000	1,691	0.4	0	0.3	0	304	10	2,570	3.3	157	16	28	1,570	3,028

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

Rebates / financial incentives:

NJ Clean Energy Prescriptive Lighting Controls – Wall-mounted occupancy sensors (\$20 per control)

Maximum incentive amount is \$100.

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 25 new CFL lamps

Description:

The DPW facility contains 25 High Intensity Discharge (HID) lamps located in garage areas that can be upgraded to reflective Compact Florescent Lamps (CFLs). CFL reflector lamps provide a high quality light that is comparable to that of HID lamps, but uses much less energy. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$250

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 25 new CFL lamps	RSMeans	4,350	0	4,350	4,698	1.0	0	0.8	19	865	5	3,937	5.0	10	2	15	2,951	8,412

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#4: *Install 10kW PV system*

Description:

Currently, the Department of Public Works 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 10kW 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 Department of Public Works 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 10kW PV installation on the building roofs 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 10kW system needs approximately 82 panels which would take up 870 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: \$60,000

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
4	Install 10kW Solar PV array on Garage roof	Similar Project	70,000	10,000	60,000	11,804	10.0	0	1.9	0	8,725	25	148,594	6.9	147	6	12	53,849	21,135

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 \$10,000.

<http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program>

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. \$6,600 has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

ECM#5: Install 8 new Pulse Start Metal Halide fixtures

Description:

The Public Works Facility currently contains 8 Probe Start Metal Halide fixtures for exterior lighting. SWA recommends replacing these fixtures with Pulse Start Metal Halide fixtures. The existing Probe Start Metal Halide fixtures are typically installed with an excessive high wattage since they degrade in light quality over time. Pulse Start Metal Halide fixtures do not degrade over time and will save on maintenance costs associated with avoided bulb replacement. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$6,242

Source of cost estimate: RS Means; Published and established costs

Economics:

ECM #	ECM description	Source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
5	Install 8 new Pulse Start Metal Halide fixtures	RSMeans	6,442	200	6,242	3,031	0.6	0	0.5	213	759	15	8,926	8.2	43.0	2.9	8.7	2,684	5,427

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

Rebates / financial incentives:

NJ Clean Energy Prescriptive Lighting – Metal Halide fixtures with Pulse Start facilities (\$25 per fixture)

Maximum incentive amount is \$200.

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#6: Remove cast iron radiator and replace with convective unit heater in smaller building garage.

Description:

SWA recommends that the existing cast iron radiator is removed from the smaller building garage and is replaced with a convective unit heater. Currently the cast iron radiator sits directly next to the garage bays and heats objects directly near it but does not do a good job of effective heating the entire garage. SWA recommends that a new convector unit is sized to meet the heating load for the garage area and is mounted from the ceiling. Convective unit heaters come equipped with a fan that will help spread evenly throughout the building. It does not appear that the garage doors for this garage are opened frequently and therefore a convective heating unit should be more efficient at heating the entire space than a cast iron radiator.

Installation cost:

Estimated installed cost: \$2,423

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
6	Remove cast iron radiator and replace with convective unit heater in smaller building garage	RS Means	3,623	0	3,623	-56	0	121	0.6	30	186	25	3,173	19.4	-12	0	2	-450	1,234

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Savings result from new unit heater being able to satisfy heating load in a shorter amount of time and shutting off. Existing cast iron radiator was allowed to transfer heat to the space for 24 hours per day and did not adequately heat the garage. Installation costs include the cost of a new unit heater at \$2,423 and 25’ of new copper piping to be installed at \$1,200.

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#7: Replace 440 MBH boiler in smaller building with high efficiency unit

Description:

The Public Works Facility – smaller building contains one Weil McLain 440 MBH boiler with a nameplate efficiency of 80% that provides hot water heating to a unit heater and baseboards in the small office areas as well as unit heaters and a cast iron radiator in the garage area. This unit is original to the building and was observed to be in deteriorating condition. It was also noted that this heating system is controlled remotely by the BMS system installed at the Town Hall building. According to building staff, this boiler is allowed to run 24 hours per day with no night setback and is allowed to run when during the winter when outside temperatures should not call for heat. SWA recommends in addition to upgrading this boiler that BMS controls are set to setback the temperature at night as well as cut off the boiler when outside temperatures reach above 55F.

Installation cost:

Estimated installed cost: \$21,730

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
7a	Replace 440 MBH boiler in smaller building	RS Means	17,500	770	16,730	0	0	164	0.8	200	426	25	7,247	39.3	-57	-2	-3	-9,483	1,808
7b	Incremental cost to replace with high efficiency unit	RS Means	5,000	0	5,000	0	0	356	1.7	0	490	25	8,337	10.2	67	3	8	3,337	3,924
7	Replace 440 MBH boiler in smaller building with high efficiency unit	RS Means	22,500	770	21,730	0	0	520	2.5	200	915	25	15,584	23.7	-28	-1	0	-6,146	5,732

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations. SWA assumes that boiler will be configured to have an outside cut off temperature of 55F as well as setback at night. The nameplate efficiency of the boiler is 80% and is assumed to have degraded to 77% over the lifetime of the equipment.

Rebates / financial incentives:

*NJ Clean Energy – Gas-heating, Gas-fired boilers >300 MBH – <1500 MBH (\$1.75 per MBH)
Maximum incentive amount is \$770.*

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#8: Replace 199 MBH boiler in larger building with high efficiency unit

Description:

The Public Works Facility – larger building contains one Weil McLain 199 MBH boiler with a nameplate efficiency of 80% that provides hot water heating to two air handlers located in the office ceiling plenum. This unit is original to the building and was observed to operating inefficiently. The heating system is operated by a BMS system located within the building and is believed to be setback at night properly as well as have an outside cutoff temperature of 55F.

Installation cost:

Estimated installed cost: \$11,465

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
8a	Replace 199 MBH boiler in larger building	RSMMeans	9,265	300	8,965	0	0	131	0.6	60	240	25	4,090	37.3	-54	-2	-3	-4,875	1,444
8b	Incremental cost to replace with high efficiency unit	RSMMeans	2,500	0	2,500	0	0	83	0.4	0	114	25	1,944	21.9	-22	-1	1	-556	915
8	Replace 199 MBH boiler in larger building with high efficiency unit	RSMMeans	11,765	300	11,465	0	0	214	1.0	60	354	25	6,033	32.4	-47	-2	-2	-5,432	2,359

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations. The nameplate efficiency of the boiler is 80% and is assumed to have degraded to 78% over the lifetime of the equipment.

Rebates / financial incentives:

NJ Clean Energy – Gas-heating, Gas-fired boilers <300 MBH (\$300 per unit)

Maximum incentive amount is \$300

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#9: Replace unit heater in lounge area of smaller building and connect to HW loop

Description:

SWA recommends replacing the existing gas-fired unit heater located in the lounge area of the smaller building with a new unit that contains a hot water coil. This unit should be configured to be setup with the existing hot water loop. This recommendation should be included as part of the recommendation above replacing the 440 MBH boiler. When the boiler is replaced, Parsippany-Troy Hills should have the HVAC contractor/engineer size the new unit heater properly and be sure that the boiler has enough capacity to support the unit. SWA assumes based on the size of the existing boiler and low efficiency that the same size boiler will be able to provide the needed capacity.

Installation cost:

Estimated installed cost: \$4,823
 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
9	Replace unit heater in lounge area of smaller building and connect to HW loop	RS Means	4,823	0	4,823	42	0	76	0.4	30	142	25	2,419	34.0	-50	-20	-2	-2,404	913

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The original unit has a thermal efficiency of 75%. Savings calculations are based on the unit receiving hot water heating via coils from a new 85% efficient boiler. Installation costs include the cost of a new unit heater at \$2,423 and 50’ of copper piping to be installed at \$2,400.

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>

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

Plases see the above recommended ECM#4.

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

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

5.6. Geothermal

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

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

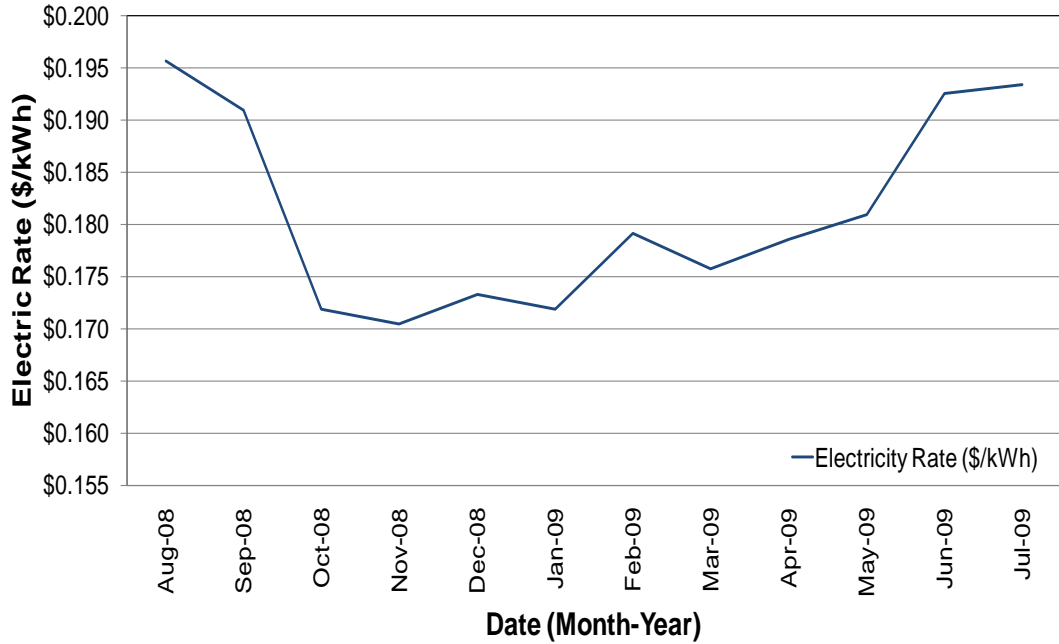
6.1. Energy Purchasing

The Department of Public Works 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 Department of Public Works 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 13% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 74% over the most recent 12 month period.

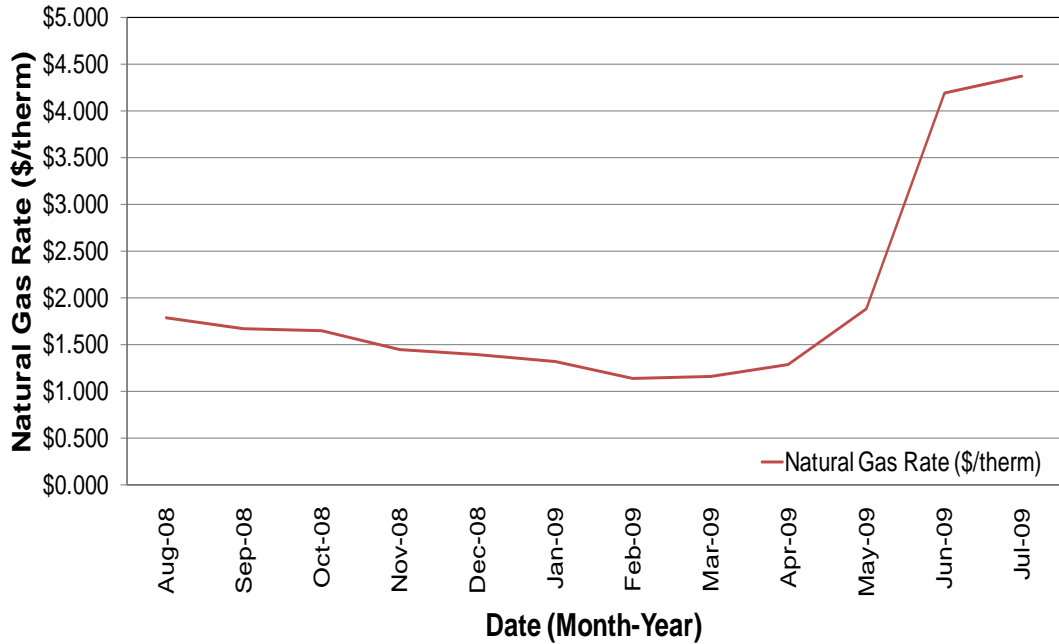
Currently, New Jersey commercial buildings of similar type pay \$0.150/kWh for electricity and \$1.55/therm for natural gas. Currently, the electricity rate for Department of Public Works is \$0.18/kWh, which means there is a potential cost savings of \$6,065 per year. The current natural gas rate for the Department of Public Works is \$1.375/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 Department of Public Works. 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.

Annual Electric Rate (\$/kWh)



Natural Gas Rate (\$/therm)



6.2. Energy Procurement strategies

Also, the Department of Public Works 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 Department of Public Works

Location			Existing Fixture Information										Retrofit Information										Annual Savings							
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps	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	Office	Parabolic	E	4'T8	4	4	32	S	8	261	13	525	1,178	C	Parabolic	4'T8	E	OS	4	4	32	6	261	13	525	883	0	294	294
2	GF	Meeting Room	Parabolic	E	4'T8	6	4	32	S	8	261	13	781	1,766	C	Parabolic	4'T8	E	OS	6	4	32	6	261	13	781	1,325	0	442	442
3	GF	Kitchen	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
4	GF	Command Room	Parabolic	E	4'T8	4	4	32	S	8	261	13	525	1,178	C	Parabolic	4'T8	E	OS	4	4	32	6	261	13	525	883	0	294	294
5	GF	Loading bay	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
6	GF	Locker Room	Parabolic	E	8'T8	2	2	59	S	8	261	13	249	547	N/A	Parabolic	8'T8	E	S	2	2	59	8	261	13	249	547	0	0	0
7	GF	Hallway	Parabolic	E	4'T8	1	1	32	S	8	261	3	35	73	N/A	Parabolic	4'T8	E	S	1	1	32	8	261	3	35	73	0	0	0
8	GF	Garage	Parabolic	E	4'T8	19	2	32	S	8	261	6	1,222	2,777	N/A	Parabolic	4'T8	E	S	19	2	32	8	261	6	1,222	2,777	0	0	0
9	GF	Bathroom Men	Parabolic	E	4'T8	3	2	32	S	8	261	6	198	438	N/A	Parabolic	4'T8	E	S	3	2	32	8	261	6	198	438	0	0	0
10	GF	Bathroom Women	Parabolic	E	4'T8	1	2	32	S	8	261	6	70	146	N/A	Parabolic	4'T8	E	S	1	2	32	8	261	6	70	146	0	0	0
11	GF	Staircase	Parabolic	E	4'T8	1	2	32	S	8	261	6	70	146	N/A	Parabolic	4'T8	E	S	1	2	32	8	261	6	70	146	0	0	0
12	GF	Meeting Rm	Parabolic	E	8'T8	2	2	59	S	8	261	13	249	547	N/A	Parabolic	8'T8	E	S	2	2	59	8	261	13	249	547	0	0	0
13	GF	Meeting Rm	Screw-in	N	CFL	6	1	15	S	8	261	0	90	188	N/A	Screw-in	CFL	N	S	6	1	15	8	261	0	90	188	0	0	0
14	GF	Locker Room	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
15	GF	Locker Room	Exit Sign	N	LED	1	1	5	N	8	261	1	6	13	N/A	Exit Sign	LED	N	N	1	1	5	8	261	1	6	13	0	0	0
16	GF	Garage	HID	N	Hal	1	1	100	S	8	261	25	125	261	CFL	Screw-in	CFL	N	S	1	1	35	8	261	0	35	73	188	0	188
17	GF	Vestibule	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
18	GF	Vestibule	Exit Sign	N	LED	1	1	5	N	8	261	1	6	13	N/A	Exit Sign	LED	N	N	1	1	5	8	261	1	6	13	0	0	0
19	GF	Boiler Room	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
20	GF	Boiler Room	Exit Sign	N	LED	1	1	5	N	8	261	1	6	13	N/A	Exit Sign	LED	N	N	1	1	5	8	261	1	6	13	0	0	0
21	GF	Meeting Room	Exit Sign	N	LED	1	1	5	N	8	261	1	6	13	N/A	Exit Sign	LED	N	N	1	1	5	8	261	1	6	13	0	0	0
22	GF	Meeting Room	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
23	GF	Office	Parabolic	E	4'T8	6	4	32	S	8	261	13	781	1,766	C	Parabolic	4'T8	E	OS	6	4	32	6	261	13	781	1,325	0	442	442
24	GF	Office	Parabolic	E	4'T8	2	4	32	S	8	261	13	269	589	N/A	Parabolic	4'T8	E	S	2	4	32	8	261	13	269	589	0	0	0
25	GF	Hallway	Parabolic	E	4'T8	4	4	32	S	8	261	13	525	1,178	N/A	Parabolic	4'T8	E	S	4	4	32	8	261	13	525	1,178	0	0	0
26	GF	Hallway	Parabolic	E	4'T8	4	4	32	S	8	261	13	525	1,178	N/A	Parabolic	4'T8	E	S	4	4	32	8	261	13	525	1,178	0	0	0
27	GF	Hallway	Parabolic	E	2'T8	4	4	17	S	8	261	5	277	610	N/A	Parabolic	2'T8	E	S	4	4	17	8	261	5	277	610	0	0	0
28	GF	Hallway	Exit Sign	N	LED	3	1	5	N	8	261	1	16	38	N/A	Exit Sign	LED	N	N	3	1	5	8	261	1	16	38	0	0	0
29	GF	Office	Parabolic	E	4'T8	2	1	32	S	8	261	3	67	146	N/A	Parabolic	4'T8	E	S	2	1	32	8	261	3	67	146	0	0	0
30	GF	Office	Parabolic	E	4'T8	9	1	32	S	8	261	3	291	658	N/A	Parabolic	4'T8	E	S	9	1	32	8	261	3	291	658	0	0	0
31	GF	Hallway	Exit Sign	N	LED	1	1	5	N	8	261	1	6	13	N/A	Exit Sign	LED	N	N	1	1	5	8	261	1	6	13	0	0	0
32	GF	Garage	Parabolic	E	2'T8	4	2	17	S	8	261	3	139	309	N/A	Parabolic	2'T8	E	S	4	2	17	8	261	3	139	309	0	0	0
33	GF	Garage	HID	N	Hal	24	1	100	S	8	261	25	2,425	6,264	CFL	Screw-in	CFL	N	S	24	1	35	8	261	0	840	1,754	4,510	0	4,510
34	GF	Bathroom Men	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
35	GF	Bathroom Women	Parabolic	E	4'T8	2	2	32	S	8	261	6	134	292	N/A	Parabolic	4'T8	E	S	2	2	32	8	261	6	134	292	0	0	0
36	GF	Office	Parabolic	E	4'T8	12	2	32	S	8	261	6	774	1,754	N/A	Parabolic	4'T8	E	S	12	2	32	8	261	6	774	1,754	0	0	0
37	GF	Hallway	Parabolic	E	2'T8	1	2	17	S	8	261	3	37	77	N/A	Parabolic	2'T8	E	S	1	2	17	8	261	3	37	77	0	0	0
38	GF	Storage Room	Parabolic	E	2'T8	1	2	17	S	8	261	3	37	77	N/A	Parabolic	2'T8	E	S	1	2	17	8	261	3	37	77	0	0	0
39	GF	Lunch Room	Parabolic	E	4'T8	6	2	32	S	8	261	6	390	877	C	Parabolic	4'T8	E	OS	6	2	32	6	261	6	390	658	0	219	219
40	Ext	Exterior	Exterior	N	MH	1	1	250	T	12	365	63	313	1,371	PSMH	Exterior	PSMH	N	T	1	1	175	12	365	38	213	933	438	0	438
41	Ext	Exterior	Exterior	N	MH	5	1	250	T	12	365	63	1,313	6,855	PSMH	Exterior	PSMH	N	T	5	1	175	12	365	38	913	4,665	2,190	0	2,190
42	Ext	Exterior	Exterior	N	Hal	2	1	100	T	12	365	25	225	1,095	PSMH	Exterior	PSMH	N	T	2	1	65	12	365	14	144	692	403	0	403
Totals:						161	85	1799				431	13,645	36,488						161	85	1,484				11,389	27,067	7,729	1,691	9,420

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

Appendix B: Third Party Energy Suppliers (ESCOs)

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrays Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integraysenergy.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 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

Appendix C: Glossary and Method of Calculations

Glossary of ECM Terms

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 expressed as 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:

	A	B	C	D	E	F	G	H	I
1									
2									
3					Year	Cash Flow			
4					0	\$(5,000.00)		Investment Cost	
5					1	\$ 850.00		Cash Flow: Annual Energy Cost Savings + Annual Maintenance Savings	
6					2	\$ 850.00			
7					3	\$ 850.00			
8					4	\$ 850.00			
9					5	\$ 850.00			
10					6	\$ 850.00			
11					7	\$ 850.00			
12					8	\$ 850.00			
13					9	\$ 850.00			
14					10	\$ 850.00			
15								Formula: =IRR(F4:F14) =NPV(0.03,F5:F14)+F4	
16					IRR	11.03%			
17					NPV	\$2,250.67			
18									
19									

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