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Local Government Energy Program
Energy Audit Report

For

Beachwood Public Works & Water Utility

1150 Beachwood Blvd
Beachwood, NJ 08722

Project Number: LGEA39

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INTRODUCTION

On November 13, 2009, Steven Winter Associates, Inc. (SWA) and PMK Group, Inc., a business unit of Birdsall Services Group (BSG-PMK), performed an energy audit and assessment for the Department of Public Works (DPW) Complex, which consists of the DPW Garage & Office building and the Water Department building. The buildings are located at 1150 Beachwood Blvd, Beachwood, NJ 08722, in Ocean County. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The facility, which is 6,000 square feet in area, was built in 1984 and consists of two one-story buildings. The facility includes the borough's public works department offices and vehicle repair garage as well as the borough's water utility. The DPW and Water Utility operate 40-60 hours each week.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of each building. Using spreadsheet-based calculation methods, SWA and BSG-PMK estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for the building are summarized in this report.

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

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 the additional 25% will also be paid by the program. The Board of Public Utilities (BPU) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

This document contains the energy audit report for the Beachwood Public Works and Water facility, located at 1150 Beachwood Blvd, Beachwood, NJ 08722.

Based on the field visit performed by Steven Winter Associates (SWA) and BSG-PMK staff on November 13, 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.

Current conditions

In the most recent full year of data collected, October, 2008 through September, 2009, the DPW facility consumed a total of 41,514 kWh of electricity for a total cost of $7,258, and 2,514 therms of natural gas for a total cost of $2,542.The Water Department facility consumed a total of 533,280 kWh of electricity for a total cost of $89,553 and 7,201 therms of natural gas for a total cost of $8,201, in the most recent full year of data collected, January, 2009 through December, 2009. In the most recent full year of data collected, January, 2009 through December 2009, the Outside Area Lighting consumed a total of 8,172 kWh for a total cost of $3,081.

With electricity and fossil fuel combined, the buildings consumed 2,209 MMBtus of energy at a total cost of $110,635.

BSG-PMK has entered energy information about the Facility in the US Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for the facility is 368 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity for a different time period can be compared to the year 2009 baseline to track the changes in energy consumption associated with the energy improvements.

Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC). BSG-PMK encourages the Borough of Beachwood to continue entering utility data in *Energy Star Portfolio Manager* in order to track whether normalized source energy use over time. The building performance rating could not be determined because this is a mixed-use facility for which there isn't any rating system at this time, comprised by non-eligible space types categorized as "Other".

(Refer to Section 1.3 for Energy Star Rating)

Category I Recommendations: Capital Improvement Measures

There are two garage doors at the DPW and two at the Water Department that should be replaced with insulated doors. The doors at the Water Department are not insulated, allowing for heat loss and increased energy consumption. The insulated garage doors would reduce annual gas consumption by 113.8 therms and annual electric consumption by 1,552 kWh, for a total savings of $340.

Replace the electric unit heater in the Water Treatment building, which has passed its useful life. This measure would not generate enough energy savings to be considered an ECM.

Replace the exhaust fans, which have passed their useful life. This measure would not generate enough energy savings to be considered an ECM.

Category II Recommendations: Operations and Maintenance

Based on the results of SWA/BSG-PMK survey, some recommendations are listed below:

Weather-strip doors at DPW

Fill and caulk gap between window frame and exterior wall.

Fix leaking pipes at Water Department.

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

At this time, SWA/BSG-PMK highly recommends a total of **6** Energy Conservation Measures (ECMs) for the DPW and Water Department that are summarized in the following tables. The total investment cost for these ECMs, without incentives, is **$81,929,** and with incentives, is **$79,928**. SWA estimates a first year savings of $**19,115** with a simple payback of **4.2 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the buildings by **154,162 lbs of CO_2**, which is equivalent to removing approximately 13 cars from the roads each year.

There are various incentives that the Borough of Beachwood could apply for that could also help lower the cost of installing the ECMs. SWA/BSG-PMK recommends that the Borough apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, could also assist to cover up to 80% of the capital investment. In order to qualify, the facility being upgraded must not have had a peak demand that exceeded 200 kW in any of the preceding 12 months; the highest peak demand for any of the buildings in the previous year was 157.2 kW.

The following 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 Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO2 Reduced, lbs/yr
1	Lighting Upgrade	Similar Projects	$3,679	$825	$2,854	6,777	2.6	0	3.85	$0.00	$1,152	15	$13,557	2.48	375%	25%	40%	$10,900	9,284
2	Replace 3 Pumps (Water Dept.)	Similar Projects, RS Means CostWorks 2009	$50,000	$666	$49,334	90,630	23.9	0	51.54	$0.00	$15,407	20	$225,036	3.20	356%	18%	31%	$179,884	124,163
TOTAL			$53,679	$1,491	$52,188	97,407	26.5	0	55.39	$0.00	$16,559	-	$238,593	3.15	-	-	-	$190,783	133,447

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 Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO2 Reduced, lbs/yr
3	Replace Unit Heaters	Similar Projects, RS Means CostWorks 2009	$5,000	$0	$5,000	0	0.0	528	8.79	$0.00	$533	13	$5,595	9.38	12%	1%	5%	$666	6,172
4	Convert DHW to Natural Gas (Water Dept.)	Similar Projects, RS Means CostWorks 2009	$7,500	$50	$7,450	7,978	2.1	-310	-0.62	$0.00	$1,003	13	$10,535	7.43	41%	3%	9%	$3,221	7,308
5	Replace Water Heater (DPW)	RS Meanns CostWorks 2009	$750	$0	$750	462	0.2	0	0.26	$0.00	$79	15	$925	9.55	23%	2%	6%	$188	633
TOTAL			$13,250	$50	$13,200	8,441	2.3	218	8.43	$0.00	$1,615	-	$17,055	8.17	-	-	-	$4,075	14,113

Table 3 - Recommended Extended-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 Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO2 Reduced, lbs/yr
6	High-Efficiency Condensing Unit and Air-Handler	Similar Projects	$15,000	$460	$14,540	4,819	1.8	0	2.74	$0.00	$942	15	$11,080	15.44	-24%	-2%	0%	-$3,299	6,602
TOTAL			$15,000	$460	$14,540	4,819	1.8	0	2.74	$0.00	$942	-	$11,080	15.44	-	-	-	-$3,299	6,602
			$81,929	$2,001	$79,928						$19,115			4.18					

Assumptions:

Discount rate:	3.2%	per DOE FEMP guidelines	Electricity rate:	$0.17 $/kWh (Entire Year)
Energy price escalation rate:	0%	per DOE FEMP guidelines		$0.20 $/kWh (Cooling Season Only)
			Gas rate:	$1.14 $/therm (Water Dept.)
				$1.01 $/therm (DPW)
			Area of Building (SF)	6,000

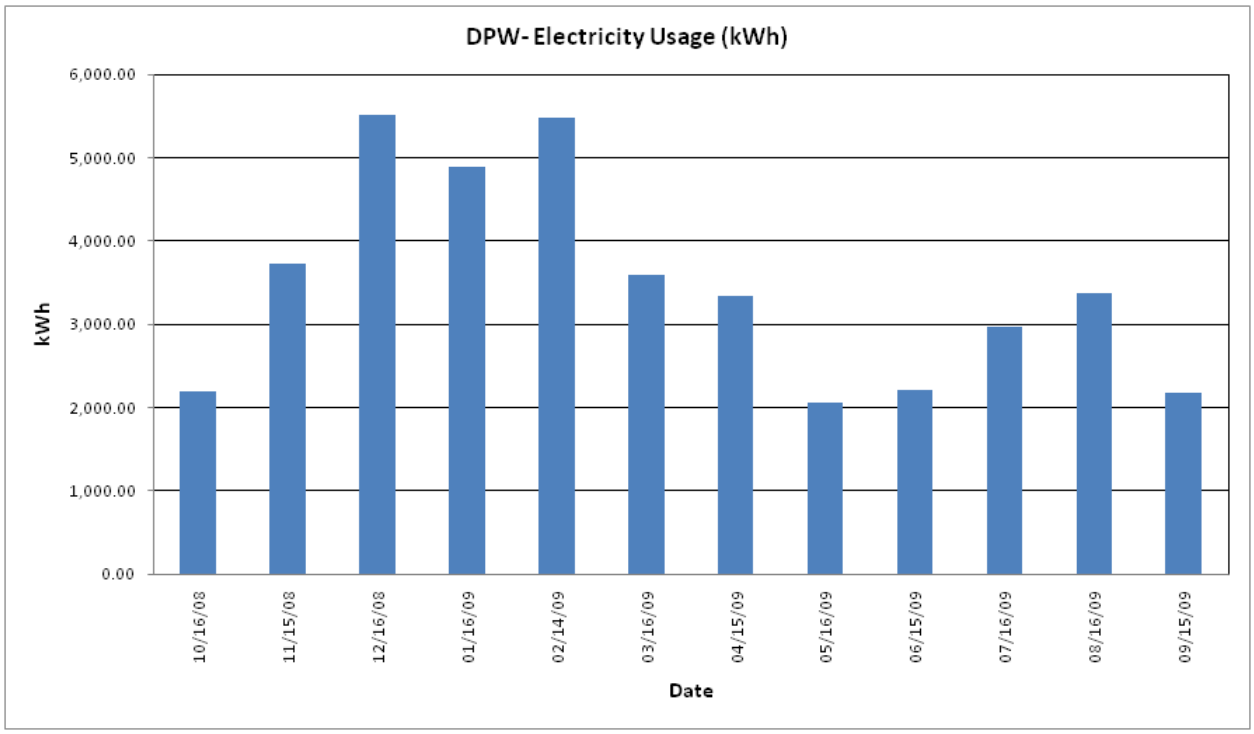
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy usage and cost analysis

SWA/BSG-PMK analyzed utility bills from October, 2007 through December, 2009 that were received from the utility companies supplying the facility with electric and natural gas.

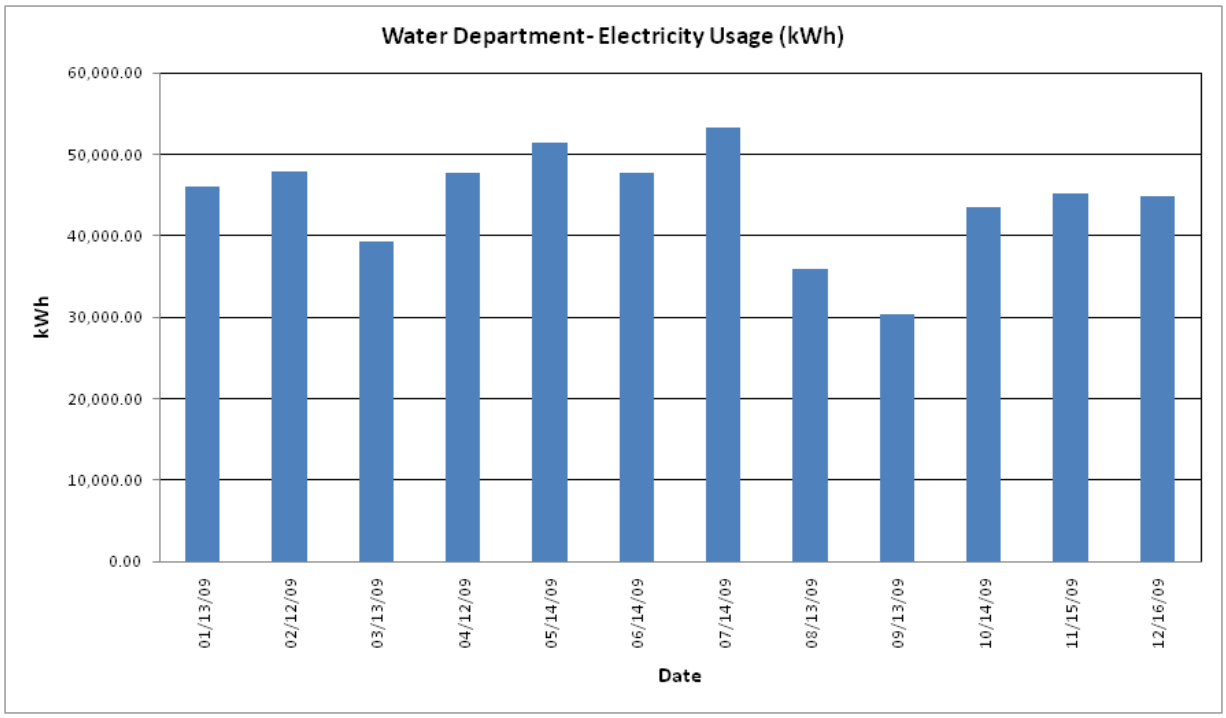
Electricity - The DPW facility is currently served by one electric meter and receives electricity from Jersey Central Power & Light at **an average rate of $0.17/kWh** based on 12 months of utility bills from October, 2008 through September, 2009. The facility purchased **41,514 kWh or $7,257.76 worth of electricity** during that time span.

The following chart shows electricity usage for the building based on utility bills from October, 2008 through September, 2009:



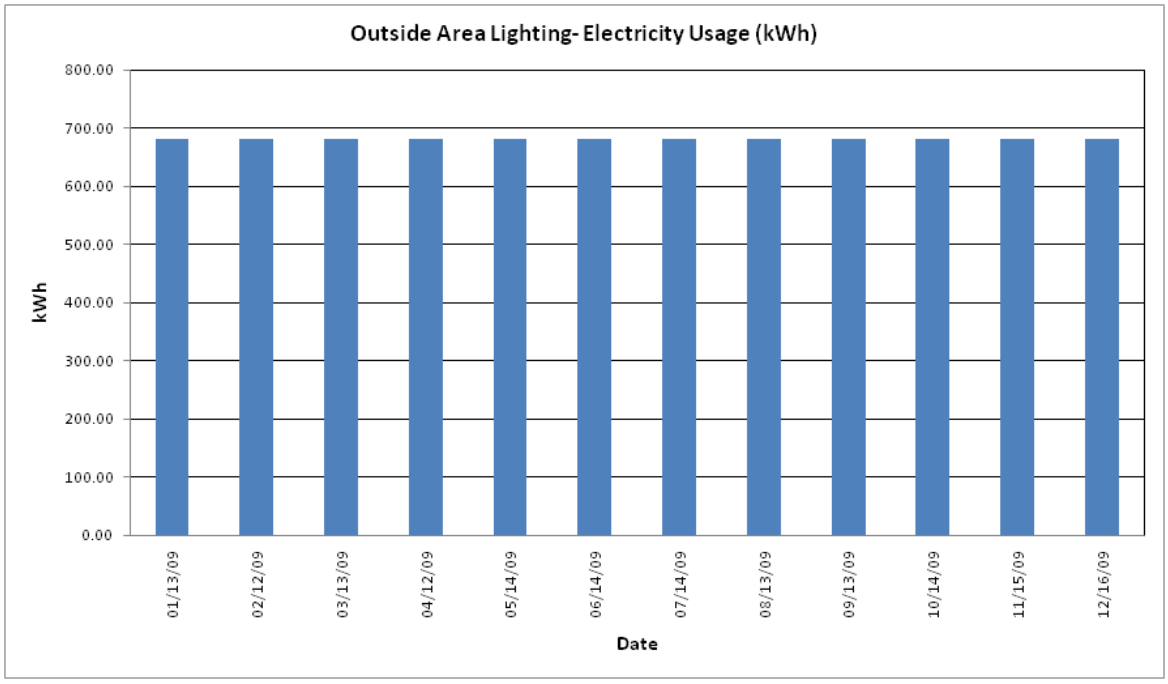
The Water Department facility is currently served by one electric meter and receives electricity from Jersey Central Power & Light at **an average rate of $0.17/kWh** based on 12 months of utility bills from January, 2009 through December, 2009. The facility purchased **533,280 kWh or $89,553 worth of electricity** during that time span.

The following chart shows electricity usage for the building based on utility bills from January, 2009 through December, 2009:



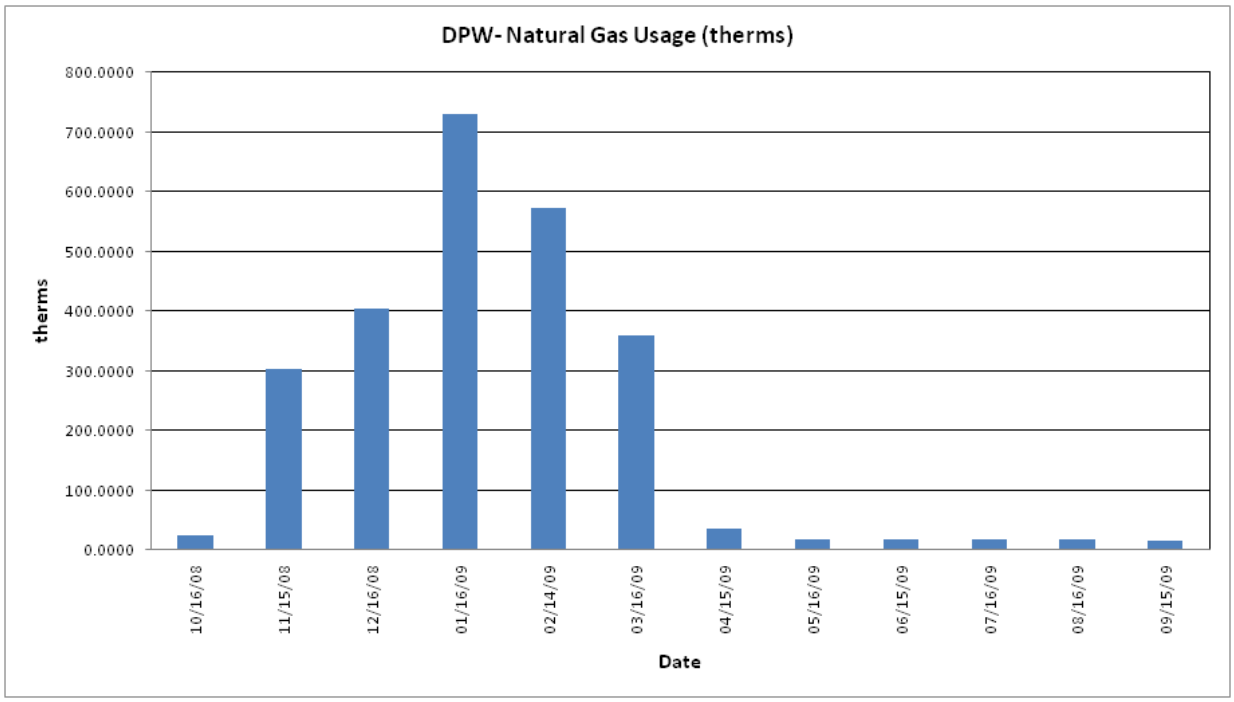
The Outside Area Lighting is currently served by one electric meter and receives electricity from Jersey Central Power & Light at **an average rate of $0.38/kWh** based on 12 months of utility bills from January, 2009 through December, 2009. The facility purchased **8,172 kWh or $3,081 worth of electricity** during that time span.

The following chart shows electricity usage for the building based on utility bills from January, 2009 through December, 2009:



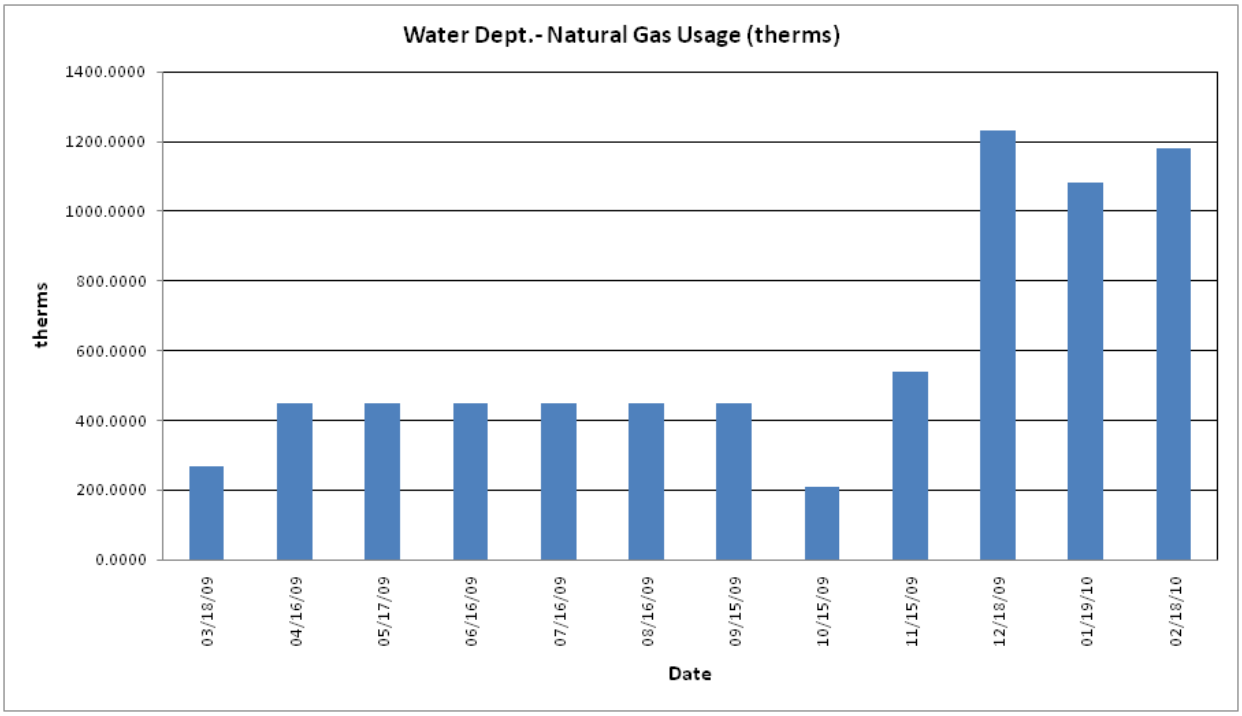
Natural Gas - The DPW Garage is currently served by one natural gas meter and receives transmission service from New Jersey Natural Gas and supply service from Pepco Energy at **an average aggregated rate of $1.01/therm** based on 12 months of utility bills from October, 2008 through September, 2009. The building purchased **2,514 therms or $2,542 worth of natural gas** during that time span.

The following chart shows the natural gas consumption for the complex based on natural gas bills for the 12 month period of October, 2008 through September, 2009:



The Water Department is currently served by one natural gas meter and receives transmission service from New Jersey Natural Gas and supply service from Pepco Energy at **an average aggregated rate of $1.14/therm** based on 12 months of utility bills from October, 2008 through September, 2009. The building purchased **7,201 therms or $8,201 worth of natural gas** during that time span.

The following chart shows the natural gas consumption for the complex based on natural gas bills for the 12 month period of March, 2008 through February, 2009:



1.2. Utility rate

The Beachwood Public Works and Water Department currently purchases electricity from Jersey Central Power & Light for electricity use (kWh) with a separate (kW) demand charge. The complex currently pays an average rate of approximately $0.24/kWh based on the utility bills from October, 2008 through December, 2009.

The Beachwood Department of Public Works currently purchases natural gas transmission from New Jersey Natural Gas and supply from Pepco Energy at an average aggregated rate of $1.01/therm based on 12 months of utility bills from March, 2008 through February, 2009.

The Water Department currently purchases natural gas transmission from New Jersey Natural Gas and supply from Pepco Energy at an average aggregated rate of $1.14/therm based on 12 months of utility bills from March, 2008 through February, 2009.

1.3. Energy Benchmarking

The building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. SWA recommends that the Borough maintain the Portfolio Manager account at the link below. As the account is maintained, SWA has shared with the Borough to allow future data to be added and tracked using the benchmarking tool.

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

Username: beachwoodboro
Password: beachwood

Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC). BSG-PMK encourages the Borough to continue entering utility data in Energy Star Portfolio Manager in order to track whether normalized source energy use over time.

The Site Energy Use Intensity is 368 kBtu/ft^{2}yr compared to the national average of 104 kBtu/ft^{2}yr for commercial buildings classified similarly by the Energy Star Portfolio Manager. Implementing this report's recommendations will reduce use by approximately 66.6 kBtu/ft^{2}yr, which when implemented would lower the buildings energy consumption. Due to the nature of its calculation based upon a survey or existing buildings of varying usage the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. Additionally, should Beachwood desire to reach this average there are other large scale and financially less advantageous improvements that can be made such as building envelope window, door and insulation replacements that would help the buildings reach this goal. The process loads associated with the buildings are also significant contributors to energy use.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
DPW and Water Dept.

Building ID: 2006305
For 12-month Period Ending: November 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 23, 2010

Facility	Facility Owner	Primary Contact for this Facility
DPW and Water Dept. 1150 Beachwood Blvd Beachwood, NJ 08722	Borough of Beachwood 1600 Pinewald Rd Beachwood, NJ 08722	Elizabeth Mastropasqua 1600 Pinewald Rd Beachwood, NJ 08722

Year Built: 1984
Gross Floor Area (ft²): 6,000

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,957,726
Natural Gas (kBtu)[4]	251,356
Total Energy (kBtu)	2,209,082
Energy Intensity[5]	
Site (kBtu/ft²/yr)	368
Source (kBtu/ft²/yr)	1134
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	311
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	432%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building envelope

2.1.1. Exterior Walls

The exterior wall envelope of the DPW Garage building consists of corrugated metal wall construction, typical for Butler type buildings, a mix of wood framed windows and aluminum framed windows, and three large garage doors. The exterior walls are insulated on the interior with 4 inch batt insulation. A portion of the building is office space and in that portion the interiors of the exterior walls are finished with gypsum wall board and wood paneling. There is a gap between where the exterior wall meets the window frame.

Category II- Repair and Maintenance: Fill and caulk gap between window frame and exterior wall.

Steel walls in good condition; Gap between exterior wall and window frame outlined in red

The above image on the left shows the exterior walls of the DPW Garage building. The above image on the right shows the gap between the exterior wall and the window frame.

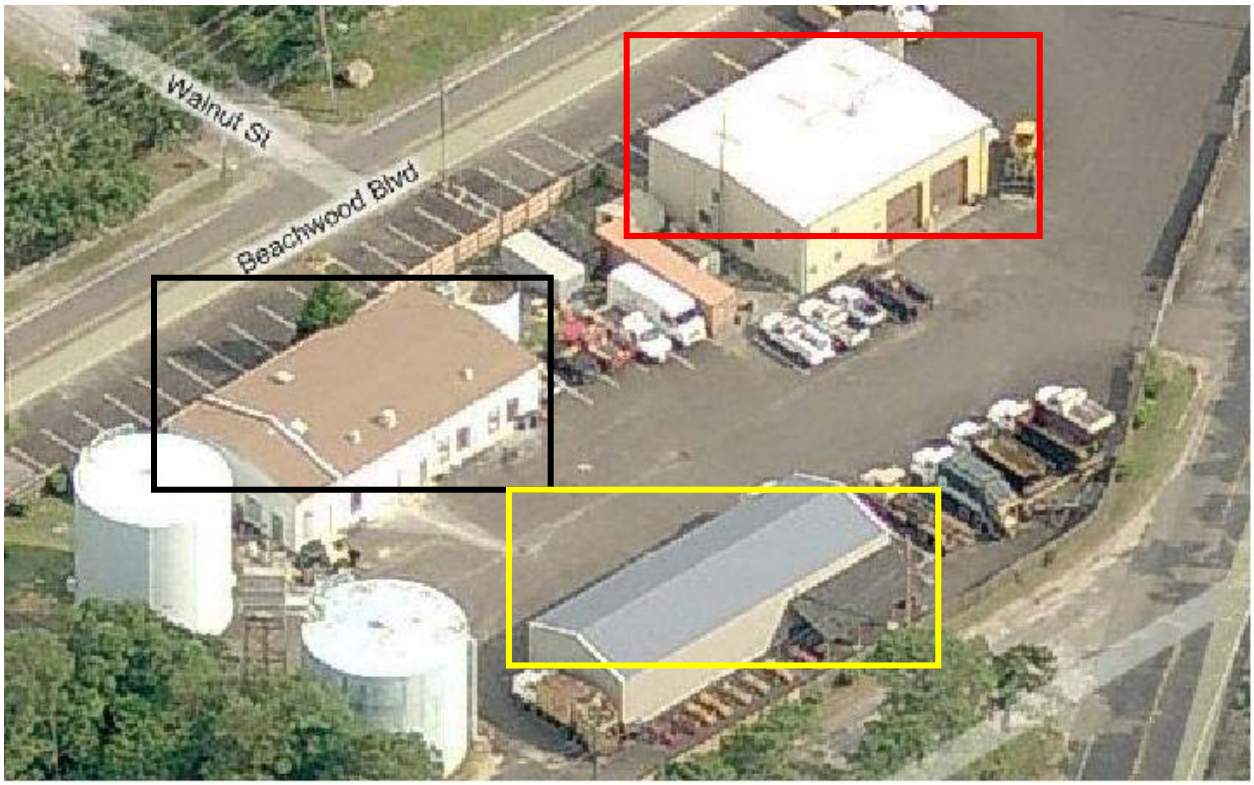
The exterior wall envelope of the Water Department building consists of CMU (Concrete Masonry Unit) walls with a textured cement finish and some vinyl siding in the front, two garage doors and 5 large aluminum single pane windows. The interior of the exterior walls is painted, but is not insulated.

CMU block walls with large aluminum single pane windows in the rear of the building.

The walls of the vehicle port structures are made of corrugated metal with a CMU base; there are only three walls to this structure. There is no interior finishing; the building is used as a vehicle port. The building is pictured below in yellow outline.

2.1.2. Roof

The DPW Garage building has a low-pitched, split-seam, steel roof. There was no water damage or leaking observed. The interior of the roof is insulated with 4" batt insulation. There are skylights in this roof and all appear to be in good condition. This is the original roof installed with the building in 1984.



Outlined in Red in the above image is DPW Garage steel roof. Outlined in Black above is the Water Dept. building asphalt shingled roof. Outlined in Yellow in the above image is a three walled steel structure used to store vehicles.

The Water Department building roof is slightly pitched and covered with asphalt shingled. The roof is separated by a CMU ridge appearing as a white line in the black box in the picture above. While no water damage or infiltration was observed at the time of the audit, it is recommended that the flashing around the ventilation fans and the ridge be maintained to prevent leaks from occurring.

The vehicle storage structure outlined in yellow in the above picture has a pitched, standing seam, corrugated metal roof. This roof appeared to be in good condition based on a visual inspection.

2.1.3. Base

The DPW Garage building's base is a 6" concrete slab-on grade with the steel structure built on top. No water seepage through the slab or other issues related to thermal performance was detected.

The Water Dept building's base is a 4"concrete slab-on grade with many pipes passing through it.

2.1.4. Windows

The windows of the DPW Garage building were a combination of wood and aluminum frames. There were a total of six windows, two with wood frames and four with aluminum frames. All the windows were single pane. The gaps between the exterior walls and the windows, as mentioned above, need to be remedied.

Single Pane Aluminum Window on the Garage

Single Pane Aluminum Window on the Water Dept building

The windows at the Water Department Building are aluminum framed single pane windows. There are a total of six windows. The windows appeared properly sealed, having no air infiltration

2.1.5. Exterior doors

The DPW Garage building has two large, insulated, overhead garage doors, as well as three steel doors, 1 5/8" thick. At the time of the audit no infiltration was observed. The two doors at the DPW are insulated; however, at the time of SWA/BSG-PMK survey of the building, there were complaints from employees about persistent issues with the doors, such as cold air infiltration, poor quality, and easy entry for insects and rodents.

Category II- Repair and Maintenance: Weather-strip doors at DPW

The Water Dept. building has one large overhead garage door and one small overhead garage door. Both aluminum doors are not insulated, but are made of thick gauge aluminum. There are also six steel doors 1 5/8" thick.

Category I Recommendation – Capital Improvements: There are two garage doors at the DPW and two at the Water Department that should be replaced with insulated doors. The doors at the Water Department are not insulated, allowing for heat loss and increased energy consumption. The insulated garage doors would reduce annual gas consumption by 113.8 therms and annual electric consumption by 1,552 kWh, for a total savings of $340.

There are no doors on the vehicle storage structure.

2.1.6. Building air tightness

Besides the aforementioned recommendations these buildings are reasonably air tight, considering the use and nature of the building construction.

2.2. HVAC Systems

2.4.1 Heating

The DPW offices are heated by two 6' electric baseboards. The garage is heated by two Janitrol gas-fired unit heaters, both of which have surpassed their useful lives. The upstairs area receives heated air from the garage.

The Water Department is heated by unit heaters. The office is heated by a small, electric Chromalox unit heater, while the tank room is heated by a Reznor gas-fired unit heater.

Category I Recommendation – Capital Improvements: Replace the electric unit heater in the Water Treatment building, which has passed its useful life. This measure would not generate enough energy savings to be considered an ECM.

Category III Recommendations – ECM #3: Replace the current unit heaters in the DPW garage with more efficient units.

2.4.2 Cooling

The DPW offices are the only conditioned space within the facility. The cooling is provided by a 5-ton AG condensing unit, and an air-handler located in the attic.

Category III Recommendation: ECM #6 – Replace the condensing unit with a newer unit that uses Puron refrigerant, rather than R-22 refrigerant, and has a higher Seasonal Energy Efficiency Ratio (SEER) rating. The air-handler should also be replaced with a unit that is compatible with the new type of refrigerant.

2.4.3 Ventilation

DPW Ventilation is provided by a tailpipe exhaust fan and two roof-mounted general exhaust fans. The through the wall fan provides ventilation to the garage area. The wall mounted exhaust fan provides ventilation for the generator. Also, the doors and windows ventilate this space.

The Water Department ventilation is provided by two Hart & Cooley Metcalf Type B gas vents, two Breident Air X-Hauster air exhausters, and two exhaust fans, all located on the roof, as well as the doors and windows.

Category I Recommendation – Capital Improvements: Replace the exhaust fans, which have passed their useful life. This measure would not generate enough energy savings to be considered an ECM.

2.4.4 Domestic Hot Water

Water is provided to both buildings by electric, domestic water heaters. The Water Department has a Turbo 82-gallon water heater and the DPW has an AO Smith has a 19-gallon water heater.

Category III Recommendation – ECM #4: Replace the current water heater at the Water Department with a gas-fired unit.

Category III Recommendation – ECM #5: Replace the current water heater at the DPW with another electric unit. The cost of piping needed to bring gas to the unit compared with the savings associated by replacing a small capacity water heater would make the initial investment too costly to yield a reasonable payback period.

2.3. Electrical systems

2.3.1. Lighting

A complete inventory of all interior, exterior, and exit sign light fixtures were examined and documented in Appendix A of this report including an estimated total lighting power consumption. Our initial findings indicate that performing a detailed lighting upgrade per the recommendations in Appendix A will result in an annual savings of $1,184.74 based on the current $0.15/kWh and the current occupancy schedule. Implementation of this ECM will cost approximately $3,679. Currently the Board of Public Utilities (BPU) would offer an estimated Rebate of $825 yielding a net cost of $2,854 for this project. With a yearly savings of $1,152, the payback on this ECM would be just about 2.5 years.

The building's lighting primarily consists of standard efficiency T-12 fixtures with magnetic ballasts and incandescent lamps. There are a few T-8 fixtures with electronic ballasts and some compact fluorescent lamps used in the stairway. All exit signs are lit by incandescent lamps and operate 24/7.

Category III Recommendation: ECM #1 – Retrofit all T-12 fixtures with energy efficient T-8 lamps & electronic ballasts and all incandescent lamps with compact fluorescents.

Lighting inventory with recommended lighting upgrades are detailed in Appendix A.

2.3.2. Appliances and process

This facility has miscellaneous kitchen appliances, which include; three mini-fridges, two regular sized refrigerators, five microwaves, three coffee makers, and two vending machines. There are five computers, as well as a washer and dryer at this facility.

2.3.3. Elevators

There are no elevators in either building.

2.3.4. Other electrical systems

The Water Department has four large pumps; two 60 HP, one 40 HP, and one 50 HP well pump. As well as a back-up generator.

Category III Recommendation – ECM #2: Replace circulation the two 60 HP pumps, #1 and #3, and the one 50 HP well pump with pumps that have premium high-efficiency motors.

3. EQUIPMENT LIST

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
DPW Main							
Heating	Two 6' electric baseboard heaters	Office space, along wall	Unknown	Electric	Office space	1984	-
Heating	50 MBH Unit heater; 80%	Garage	Janitrol M# WH-050	Natural Gas	Garage	1984	0%
Heating	Unit Heater, approx. 100 MBH, 80% efficient	Garage	Janitrol (no namplate)	Natural Gas	Garage	1984	0%
Cooling	5-ton condensing unit	Outside building	AG M# AG 060 G82	Electric	AHU	Approx. 1995	0%
	AHU	Attic	Not accessible	Electric	Office space	1984	0%
Ventilation	Tailpipe exhaust system	Garage	No nameplate	Electric	Garage	1984	0%
Ventilation	Wall-mounted general exhaust fan	Garage	No nameplate	Electric	Backup Generator	1984	0%
Domestic Hot Water	Electric water heater; 19 gallons, 2.5 kW	Upstairs office	AO Smith M# EEJF 20 913	Electric	Sinks	1992	0%
Ventilation	Through-the-wall fan	Garage	No nameplate	Electric	Garage	1984	0%
Ventilation	2 exhaust fans on roof (no access)	Roof	Roof not accessible	Electric	Garage	1984	0%
Water Treatment Building							
Pumping	Circulation pump #1: 60 HP, 3545 RPM	Tank room	S# 1196612 (manufacturer not legible)	Electric	Large tanks	Approx. 1985	0%
Pumping	Circulation pump #2 w/ premium motor: 40 HP, 3540 RPM	Tank room	Baldor Cat.# EM 2538T	Electric	Large tanks	Approx. 2007	80%
Pumping	Circulation Pump #3: 3520 RPM, 60 HP	Tank room	Baldor M# M2546T	Electric	Large tanks	Approx. 1985	0%
Pumping	Well #5: Vertical 50 HP pump; 1175 RPM;	Tank room	US Electric Motors ID# 6234-50-V12V288R086M	Electric	Punping System	Approx. 1985	0%
Pumping	Lime pump: 3/4 HP, 1725 RPM, 80% efficient	Tank room	Baldor Cat.# IDNM 3542	Electric	Lime feeding system	Approx. 2005	67%
Pumping	Lime pump: 3/4 HP, 1725 RPM, 80% efficient	Tank room	Baldor Cat.# 1DNB 3542	Electric	Lime feeding system	Approx. 2005	67%
Ventilation	2 Metlcap Type B Gas Vents	Roof	Hart & Cooley M# FRHW	Electric	Tank room, work area	Approx. 1985	0%
Ventilation	2 air exhausters	Roof	Breidert Air-X-Hauster Type 18F	Electric	Tank room, work area	Approx. 1985	0%
Ventilation	2 exhaust fans	Roof	No nameplate	Electric	Tank room	Approx. 1985	0%
Heating	Small unit heater	Office	Chromalox (nameplate not accessible)	Electric	Office	Approx. 1985	0%
Heating	Unit Heater, approx. 100 MBH, 80% efficient	Tank room	Reznor V3 TCORE (no nameplate)	Natural Gas	Tank room	Approx. 2005	67%
Domestic Hot Water	Electric water heater; 82 gallons, heating capacity not legible	Tank room	Turbo (model # not legible)	Electric	Entire building	Approx. 1985	0%

Note: The remaining useful life of a system (in %) is the relationship between the system manufactured and / or installed date and the standard life expectancy of similar equipment based on ASHRAE (2003), ASHRAE Handbook: HVAC Applications, Chapter 36.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Beachwood Department of Public Works and Water Department, SWA/ BSG-PMK 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 Improvement Measures

There are two garage doors at the DPW and two at the Water Department that should be replaced with insulated doors. The doors at the Water Department are not insulated, allowing for heat loss and increased energy consumption.

Replace the electric unit heater in the Water Treatment building, which has passed its useful life. This measure would not generate enough energy savings to be considered an ECM.

Replace the exhaust fans, which have passed their useful life. This measure would not generate enough energy savings to be considered an ECM.

Category II Recommendations: Operations and Maintenance

Based on the results of SWA/BSG-PMK survey, some recommendations are listed below:

Weather-strip doors at DPW

Fill and caulk gap between window frame and exterior wall.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM #	Description
1	Lighting Upgrade
2	Replace 3 Pumps (Water Dept.)
3	Replace Unit Heaters
4	Convert DHW to Natural Gas (Water Dept.)
5	Replace Water Heater (DPW)
6	High-Efficiency Condensing Unit and Air-Handler

ECM#1: Lighting Upgrade

Description:
Lighting at the Department of Public Works and the adjacent Water Treatment Building consist primarily of T-12 fluorescent bulbs with magnetic ballasts. It is recommended that all T-12 fixtures with magnetic ballasts be replaced with T-8 fixtures with electronic ballasts. Lighting replacement generally yields a very good payback, due to the fact that installation is inexpensive. A few fixtures at the facilities have already been upgraded to T-8's.

Also in the building are incandescent lamps of various wattages. It is recommended that these be replaced with compact fluorescents. All exit signs have been upgraded to energy-efficient light-emitting diode (LED) fixtures.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost:
Estimated installed cost: $3,679
Source of cost estimate: Similar projects, empirical data

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 Energy 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	Lighting Upgrade	Similar Projects	$3,679	$825	$2,854	6,777	2.6	0	3.85	$0.00	$1,152	15	$13,557	2.48	375%	25%	40%	10,900	9,284

Assumptions:
The electric cost used in this ECM was $0.17/kWh, which was the DPW's average rate for the 12-month period ranging from October 1, 2008 through September 30, 2009. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix A.

Rebates/financial incentives:
The New Jersey SmartStart rebate for upgrading lighting fixtures to LED exit signs and T-8 lamps ranges from $10 to $20 per fixture. The total rebate this ECM qualifies for is $825.

ECM#2: Replace 3 Pumps (Water Dept.)

Description:
There are four large pumps at the Water Department, of which three have passed their useful lives and should be replaced. The three pumps that are recommended for replacement are circulation pump #1, which has a 60 HP motor; circulation pump #3, which has a 60 HP Baldor motor; and Well Pump #5, which has a 50 HP Baldor motor. High-efficiency premium motors are available, which have efficiencies up to 95%.

Installation cost:
Estimated installed cost: $6,500 for each 60 HP pump, $5,000 for the 50 HP pump, $500 each for labor
Source of cost estimate: Contractor

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 Energy 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	Replace 3 Pumps (Water Dept.)	Similar Projects, RS Means CostWorks 2009	$50,000	$666	$49,334	90,630	23.9	0	51.54	$0.00	$15,407	20	$225,036	3.20	356%	18%	31%	$179,884	124,163

Assumptions:
The cost of electricity at the Water Department, taken from twelve months of electricity bills, is currently $0.17/kWh. The horsepower ratings of the three motors were converted to kW by multiplying by a factor of 0.746. It was estimated that the pumps operate 25% of the year (2,190 hours). The efficiencies of the proposed pumps is 95%. The efficiencies of the current pumps were% 90.2% at the time of purchase; currently, they are about 3.5% less, or 87.7%, due to re-winding. The savings were calculated using the following equations:

$$\text{Current electric input(kWh)} = 2{,}190 \text{ hrs} \times 0.746 \frac{\text{kW}}{\text{HP}} \times (60 \text{ HP} + 60 \text{ HP} + 60 \text{ HP}) = 277{,}736 \text{ kWh}$$

$$\text{Current electric output (kWh)} = 277{,}736 \text{ kWh} / 87.7\% = 316{,}688 \text{ kWh}$$

$$\text{Proposed electric output (kWh)} = \frac{277{,}736 \text{ kWh}}{95\%} = 292{,}353 \text{ kWh}$$

Savings (kWh)=316,688 kWh-292,353 kWh=24,335 kWh

Rebates/financial incentives:
This ECM is calculated based on a possible eligibility for New Jersey's SmartStart Rebate, which is approximately $234 for each 60 HP motor and $198 for the 50 HP motor.

ECM#3: Replace Unit Heaters (DPW)

Description:
The DPW Garage is heated by two gas-fired Janitrol unit heaters. They have all surpassed their useful lives and should be replaced. One unit is 50 MBH, and the other is approximately 100 MBH. It is recommended that these heaters be replaced with new unit heaters. The proposed efficiencies are 81%.

Installation cost:
Estimated installed cost: $5,000 (approximately $2,000 for the 50 MBH unit, $3,000 for the 100 MBH unit)
Source of cost estimate: Similar projects, RS Means CostWorks 2009

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 Energy 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	Replace Unit Heaters	Similar Projects, RS Means CostWorks 2009	$5,000	$0	$5,000	0	0.0	528	8.79	$0.00	$533	13	$5,595	9.38	12%	1%	5%	$666	6,172

Assumptions:
The cost per therm of natural gas, $1.01/therm, was used taken from the average of twelve months of the DPW's billing period. It was determined from the energy bills was the annual heating consumption for all gas-fired heating units in the DPW and Water Department buildings was 2,514 therms. The proposed heaters are 81% efficient. The current unit heaters, due to the age and condition of the units, are assumed to have an efficiency of 64%, or 80% of the original efficiency. The saving was calculated using the following series of equations:

Current gas input: 2,514 therms

Current/proposed gas output: 2,514 therms×64%=1,609 therms

Proposed gas input: $\frac{1{,}609 \text{ therms}}{81\%}$=1,986 therms

Savings: 2,514 therms-1,986 therms=528 therms

Rebates/financial incentives:
No rebates or incentives for unit heaters could be found.

ECM#4: Convert Water Heater to Natural Gas (Water Treatment Building)

Description:
Water is heated at the Water Treatment Building by an 82-gallon Turbo electric water heater. The heating capacity of this could not be found. As there is natural gas service at the facility, it is recommended that the unit be replaced by a gas-fired water heater, due to the fact that electricity is usually much more expensive on a per-therm basis. While this would not reduce the building's overall energy consumption, the $1,14/therm paid for natural gas, compared to the $1.50/therm that is generally paid for gas, makes this ECM one that would greatly decrease the amount of money required to heat the water. The rate of $0.17/kWh that the department currently pays for electricity is actually 760% higher than the rate paid for natural gas, on a per-therm basis.

Installation cost:
Estimated installed cost: Equipment: $4,000; labor: $3,500; total: $7,500
Source of cost estimate: Similar projects, RS Means CostWorks 2009

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 Energy 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	Convert DHW to Natural Gas (Water Dept.)	Similar Projects, RS Means CostWorks 2009	$7,500	$50	$7,450	7,978	2.1	-310	-0.62	$0.00	$1,003	13	$10,535	7.43	41%	3%	9%	$3,221	7,308

Assumptions:
Using the facility's electricity bills from October 1st, 2008 through September 30th, 2009, it was determined that the cost of electricity is currently $0.17/kWh; during this same time period, the cost of natural gas was $1.14/therm.

To calculate the savings from switching from electricity to gas, a spreadsheet created by Rheem was used. The temperature rise of the heated water was set at 77°F on the spreadsheet, and the energy factor (a unit that specifies the efficiency of water heaters) is specified as 0.94 for new electric units. The current heater, due to the fact that it has surpassed its useful life, can be assumed to have an energy factor that is 75% of its original, which would make the current energy factor 0.71. Gas-fired water heaters typically have an energy factor of approximately 0.62. Weight of water was set at 8.33 pounds/ft.^{3}. Using this data, the BTUs of output heat used for heating the water were calculated by the following equation:

$$BTUs_{output} = Vol. \times Wt._{Water} \times \Delta Temp.$$

This value would be the same for the current and proposed units. The actual BTUs purchased by each unit are calculated using this value and the energy factors:

$$BTUs_{input} = \frac{BTUs_{output}}{\text{Energy Factor}}$$

The annual costs for heating the water can now be calculated using this data:

Current

Volume of Heated Water (gal)	Water Weight (lbs/ft³)	Temp. Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/kWh	Daily Cost to Heat Water	Annual Cost to Heat Water
82	8.33	77	52,596	0.71	74,604	$0.1700	$3.716	$1,356.33

Proposed

Volume of Heated Water (gal)	Water Weight (lbs/ft³)	Temp. Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/therm	Daily Cost to Heat Water	Annual Cost to Heat Water
82	8.33	77	52,596	0.62	84,832	$1.14	$0.967	$352.98

Rebates/financial incentives:
Natural gas water heaters are eligible for a New Jersey SmartStart rebate of $50.

ECM#5: Replace Water Heater (Water Treatment Building)

Description:
Water is heated at the DPW by a 19-gallon AO Smith electric water heater. The unit has passed its useful life. While there is gas at the facility, the cost of piping that would be required for a connection to a new natural gas water heater compared to the savings associated with replacing a small capacity water heater, would not make an upgrade to natural gas worth the cost of installation. Therefore, simply replacing this unit with a newer and more efficient electric unit would be sufficient. Newer water heaters have better insulation, improving the efficiency of the units.

Installation cost:
Estimated installed cost: $750
Source of cost estimate: Similar projects, RS Means CostWorks 2009

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 Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
5	Replace Water Heater (DPW)	RS Meanns CostWorks 2009	$750	$0	$750	462	0.2	0	0.26	$0.00	$79	15	$925	9.55	23%	2%	6%	$188	633

Assumptions:
Using the facility's electricity bills from October 1st, 2008 through September 30th, 2009, it was determined that the cost of electricity is currently $0.17/kWh. To calculate the savings for a more efficient electric unit, a spreadsheet created by Rheem was used. The temperature rise of 77°F for the heated water was used, and the energy factor (a unit that specifies the efficiency of water heaters) of 0.94 was used for new electric units. The current heater, due to the fact that it has surpassed its useful life, can be assumed to have an energy factor that is 75% of its original, which would make the current energy factor 0.71. Weight of water was set at 8.33 pounds/ft.^{3}. Using this data, the BTUs of output heat used for heating the water were calculated by the following equation:

$$BTUs_{output} = Vol. \times Wt._{Water} \times \Delta Temp.$$

This value would be the same for the current and proposed units. The actual BTUs purchased by each unit are calculated using this value and the energy factors:

$$BTUs_{input} = \frac{BTUs_{output}}{Energy\ Factor}$$

The annual costs for heating the water is calculated as shown below:

Current

Volume of Heated Water (gal)	Water Weight (lbs/ft³)	Temp. Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/kWh	Daily Cost to Heat Water	Annual Cost to Heat Water
19	8.33	77	12,187	0.71	17,286	$0.1700	$0.861	$314.27

Proposed

Volume of Heated Water (gal)	Water Weight (lbs/ft³)	Temp. Rise (°F)	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	$/kWh	Daily Cost to Heat Water	Annual Cost to Heat Water
19	8.33	77	12,187	0.94	12,965	$0.1700	$0.646	$235.70

Rebates/financial incentives:
Natural gas water heaters are eligible for a New Jersey SmartStart rebate of $50.

ECM#6: Replace Condensing Units & AHUs

Description:
The office area of the main DPW facility is cooled by 5-ton AG High Efficiency condensing unit and an air handler located in the attic. These units have reached the end of their useful lives, and more energy-efficient models are available. The newer condensing units use Puron refrigerant, a more efficient fluid than the current refrigerant, R-22. It is recommended that that the current condensing unit be replaced with one that has a higher Seasonal Energy Efficiency Ratio (SEERs); units with SEERs up to 21 are available. The air handler must be replaced with one that is compatible with condensing units that use Puron. The SEER of the current unit was approximately 11 at the time of its purchase; based on its age and condition, it can be estimated that the SEER has decreased by 25%, to 8.25.

Installation cost:

	Equipment	Labor	**Total**
Condensing Unit	$4,400	$5,100	**$9,500**
Air-Handler	$3,500	$2,000	**$5,500**
Total	**$7,900**	**$7,100**	**$15,000**

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 Energy 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	High-Efficiency Condensing Unit and Air-Handler	Similar Projects	$15,000	$460	$14,540	4,819	1.8	0	2.74	$0.00	$942	15	$11,080	15.44	-24%	-2%	0%	-$3,299	6,602

Assumptions:
Using the facility's electricity bills from October 1st, 2008 through September 30th, 2009, it was determined that the cost of electricity during the cooling season (May through September) is currently $0.17/kWh. SEER values, as stated above, are 8.25 for the current unit and 21 for the proposed one. 864 cooling degree-days and a 0.4% dry-bulb temperature of 91°F were used for calculations; this data was provided by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). The desired indoor temperature during the cooling season was assumed to be 72°F. The following equation, the degree-day equation for cooling systems, was used to calculate the electric consumptions of the current and proposed air-conditioners:

$$\frac{\text{Capacity}\times\text{Degree-Days}\times 24\ \frac{\text{hours}}{\text{day}}}{1{,}000\times\text{EER}\times\left(\text{Temp.}_{0.4\%}-\text{Temp.}_{\text{indoor}}\right)}=\text{Electric Consumption (in kWh)}$$

Rebates/financial incentives:
This ECM is eligible for New Jersey's SmartStart rebate, which pays up to $92 per ton for unitary air-conditioning systems, or $460 for this ECM.

BSG-PMK/SWA has reviewed several funding options for the purposes of subsidizing the costs for installing the energy conservation measures noted within this report.

Although funding options are constantly changing and updating this project may benefit from enrolling in a number of alternative programs such as the; The NJ SmartStart program with Technical Assistance, alternate funding by applying for financing and competitive grants through the United States Department of Energy as well as local utility incentive programs in an effort to offset a portion of the cost of ECM implementation.

The Smart Start program offers reimbursement incentives for various equipment purchases, and lighting incentives. The benefits and requirements of this program can be found at:
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

Financial assistance is also available through the United States Department of Energy in the form of; Grants, Cooperative Research and development agreements, small business innovation research, and Loan Guarantee Programs. Further information for these programs is available at:
http://www1.eere.energy.gov/financing/types_assistance.html

Local Utility incentives such as a Direct Install Program, offer incentives that can provide up to 80% subsidy of the cost to install particular ECM's. As each utility company has different guidelines and incentives it is important to contact your local utility authority for eligibility in these programs.

Additional funding may also be found through the following funding methods:

- Energy Savings Improvement Program (ESIP) – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements.

- Municipal Bonds – Municipal bonds are a bond issued by a city or other local government, or their agencies. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

- Power Purchase Agreement – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system.

BSG-PMK/SWA recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Solar Photovoltaic

Photovoltaic (PV) technology would feasible for this site because the roofs of the buildings are not orientated toward the south, the do not appear to be structurally strong enough to support the additional weight of the panels and as such would not receive State incentives and are not recommended.

5.3. Solar Thermal Collectors

Solar thermal collectors are not cost effective for this project and are not recommended due to the low amount of domestic hot water use throughout the building.

5.4. Combined Heat and Power

CHP is not applicable to this project because of the HVAC system type and limited domestic hot water usage.

5.5. Geothermal

Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.

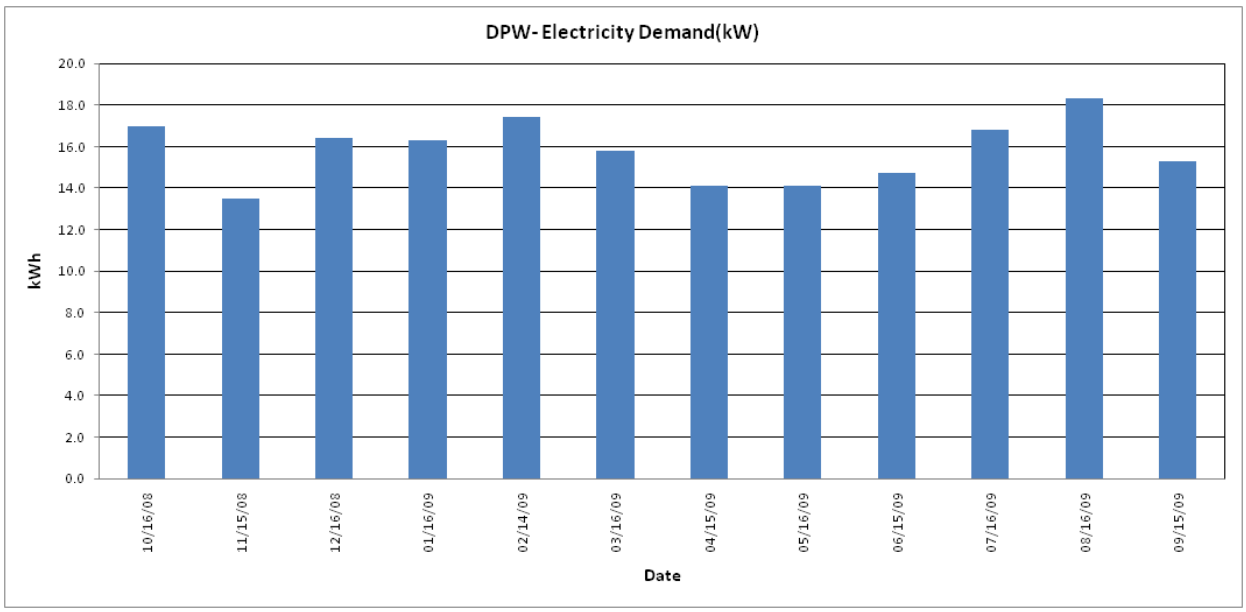
5.6. Wind

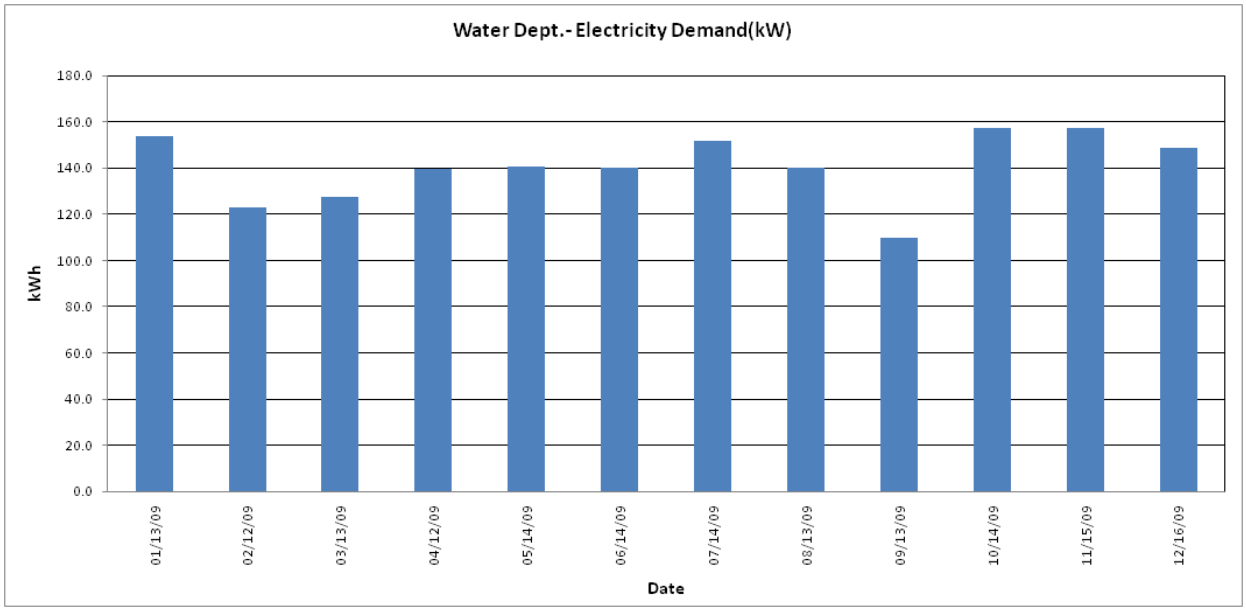
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

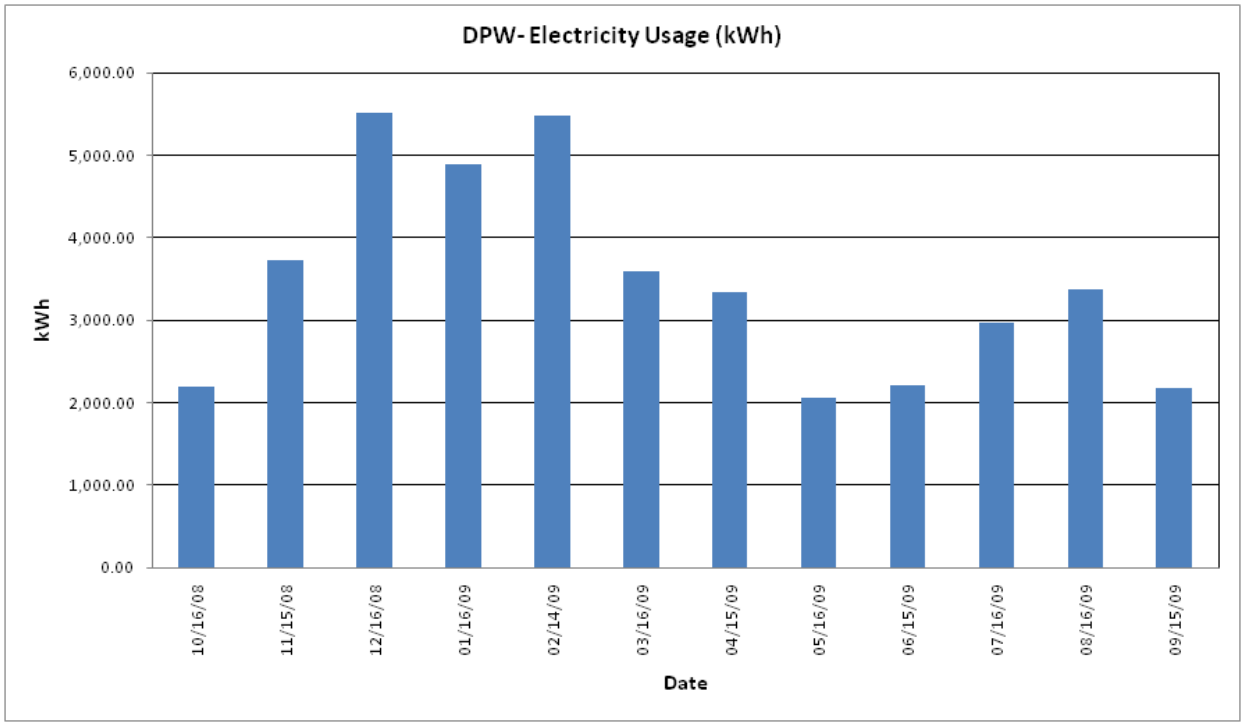
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

The average electrical peak demand for the DPW facility during previous year was 15.8 kW and the maximum peak demand was 18.3 kW. The average electrical peak demand for the Water Dept. facility during previous year was 140.8 kW and the maximum peak demand was 157.2 kW. The electric and gas load profiles for this project are presented in the following charts. The first two charts show the electric demand (in kW) for the previous 12 months and the other three charts show electric (in kWh) and gas usage (in therms), respectively.


DPW- Electricity Demand(kW)
kWh
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
10/16/08
11/15/08
12/16/08
01/16/09
02/14/09
03/16/09
04/15/09
05/16/09
06/15/09
07/16/09
08/16/09
09/15/09
Date


Water Dept.- Electricity Demand(kW)
kWh
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
01/13/09
02/12/09
03/13/09
04/12/09
05/14/09
06/14/09
07/14/09
08/13/09
09/13/09
10/14/09
11/15/09
12/16/09
Date


DPW- Electricity Usage (kWh)
6,000.00
5,000.00
4,000.00
3,000.00
2,000.00
1,000.00
0.00
kWh
10/16/08
11/15/08
12/16/08
01/16/09
02/14/09
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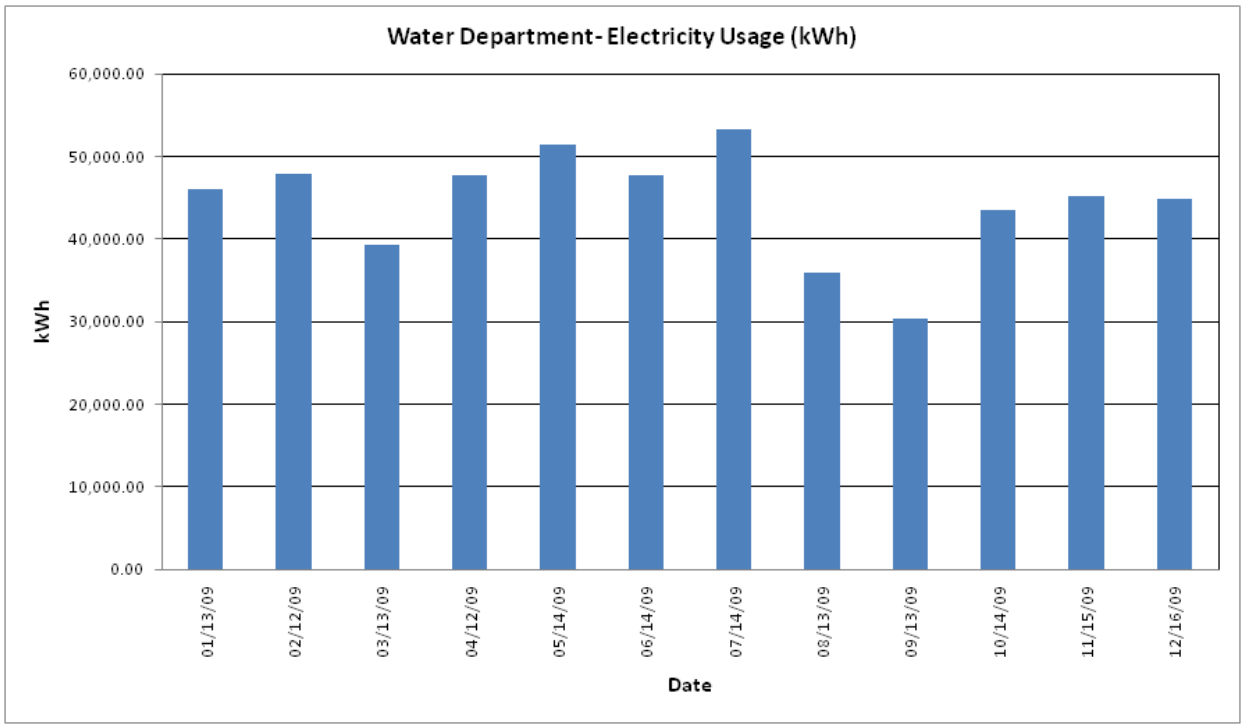
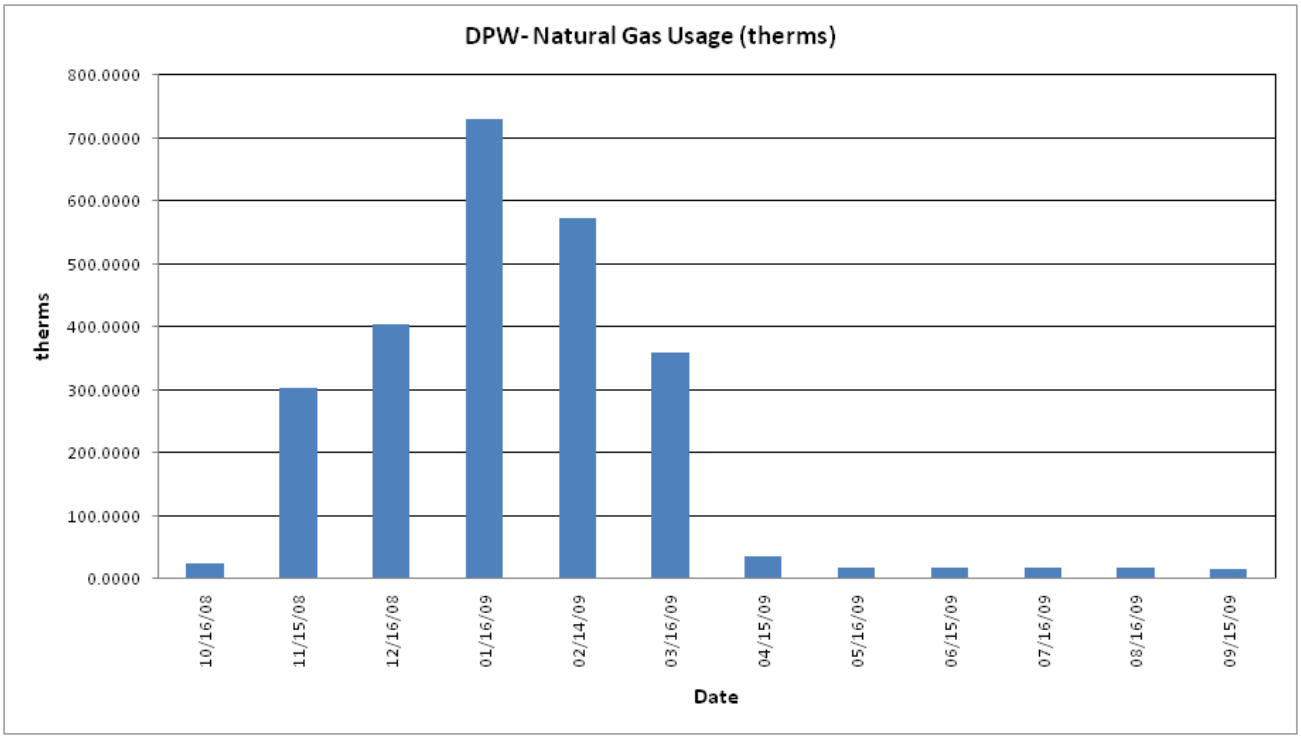
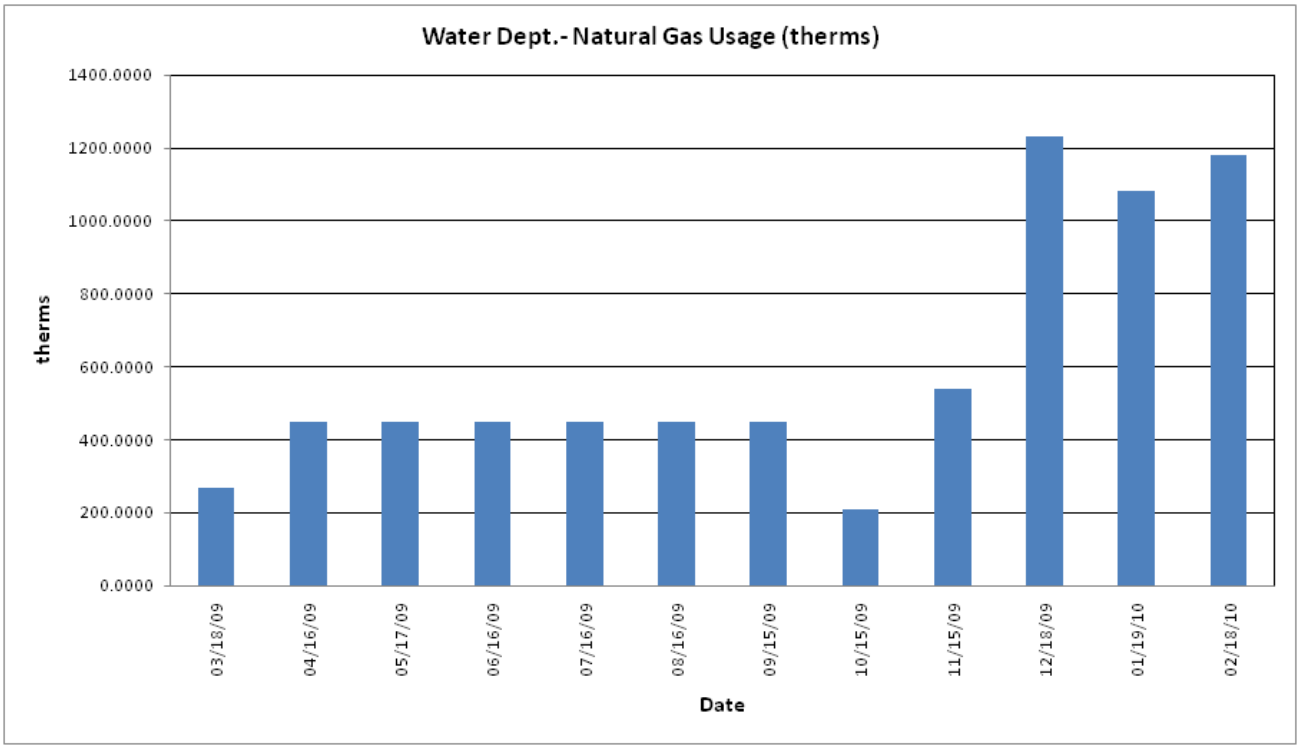
04/15/09
05/16/09
06/15/09
07/16/09
08/16/09
09/15/09
Date


Water Department- Electricity Usage (kWh)
60,000.00
50,000.00
40,000.00
30,000.00
20,000.00
10,000.00
0.00
kWh
01/13/09
02/12/09
03/13/09
04/12/09
05/14/09
06/14/09
07/14/09
08/13/09
09/13/09
10/14/09
11/15/09
12/16/09
Date

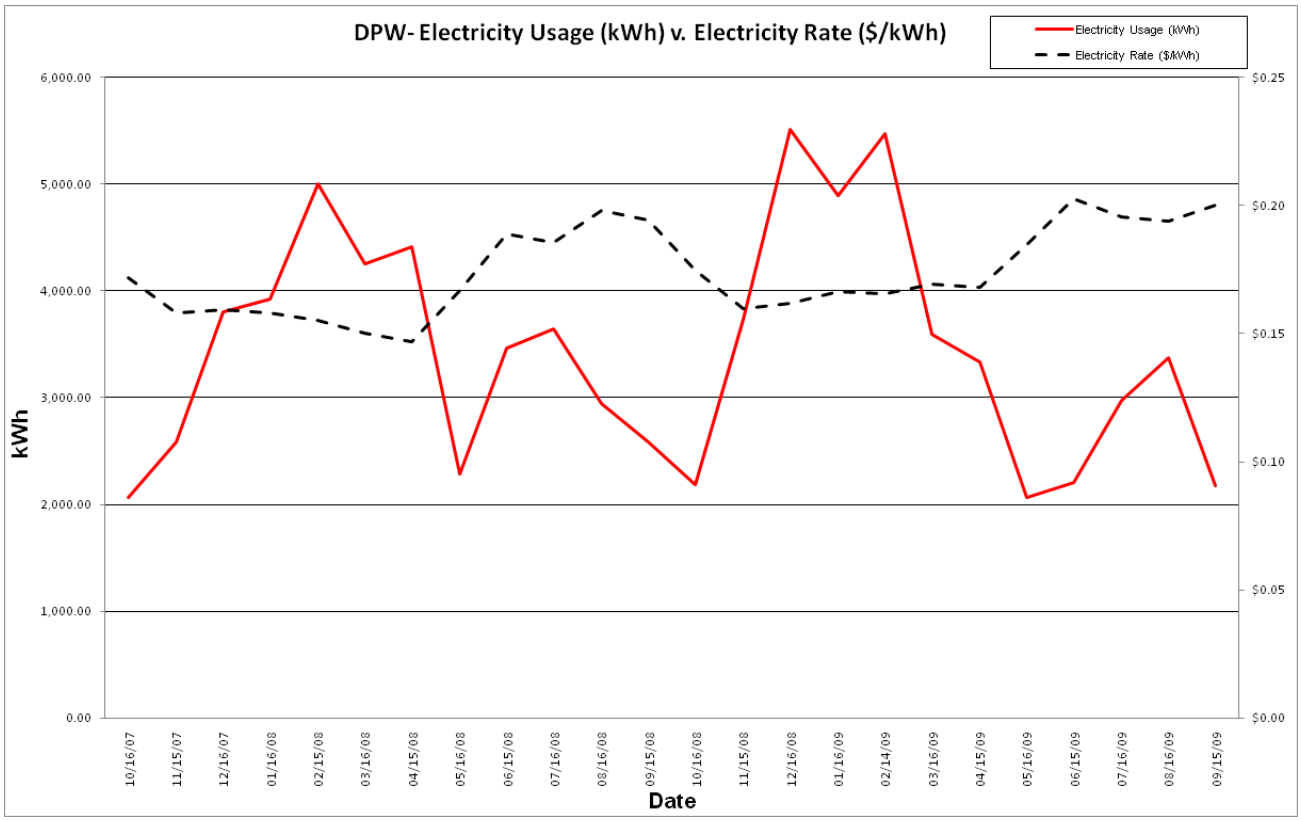

DPW- Natural Gas Usage (therms)
800.0000
700.0000
600.0000
500.0000
400.0000
300.0000
200.0000
100.0000
0.0000
therms
10/16/08
11/15/08
12/16/08
01/16/09
02/14/09
03/16/09
04/15/09
05/16/09
06/15/09
07/16/09
08/16/09
09/15/09
Date


Water Dept.- Natural Gas Usage (therms)
1400.0000
1200.0000
1000.0000
800.0000
600.0000
400.0000
200.0000
0.0000
therms
03/18/09
04/16/09
05/17/09
06/16/09
07/16/09
08/16/09
09/15/09
10/15/09
11/15/09
12/18/09
01/19/10
02/18/10
Date

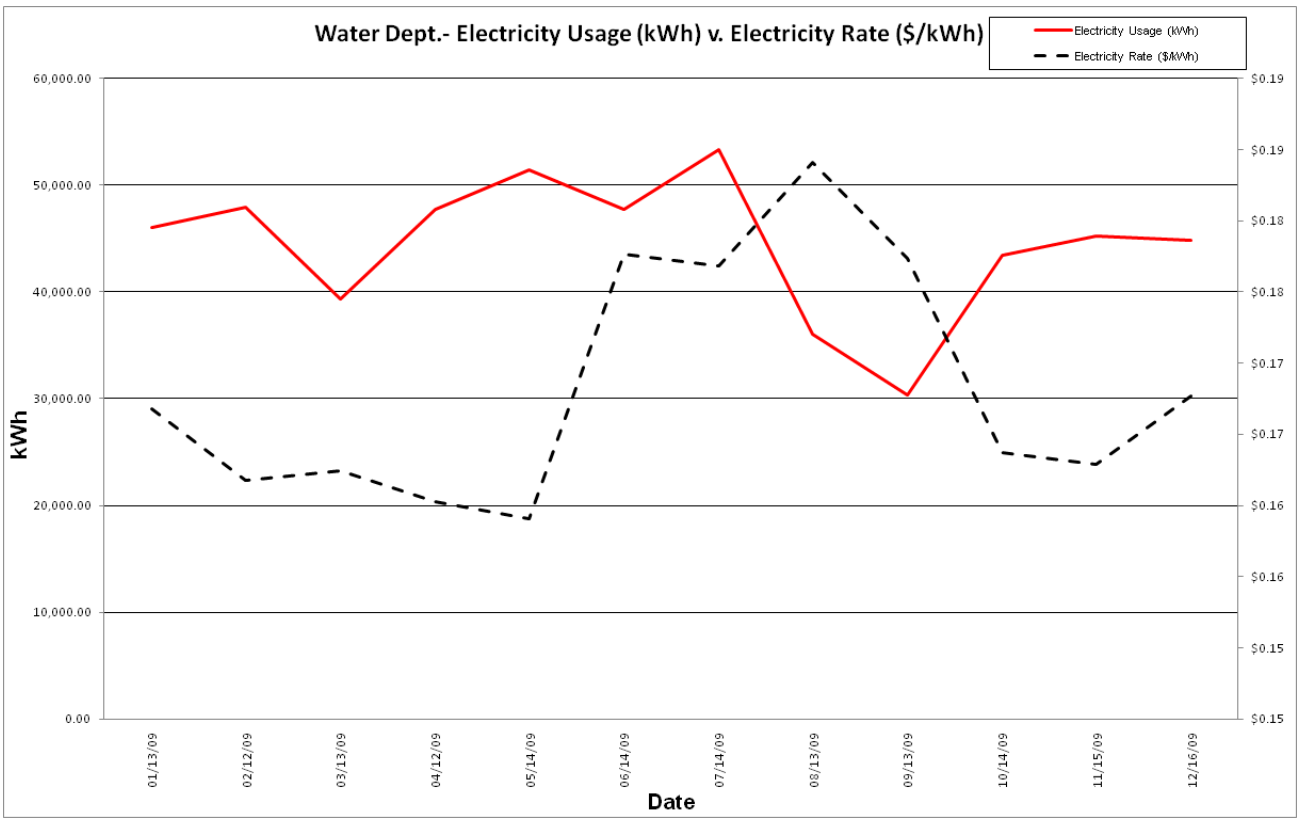
6.2. Energy Procurement strategies

Billing analysis shows price fluctuations over the course of the year for the building electrical and natural gas accounts. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Purchasing electricity from an ESCO can reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the facility.

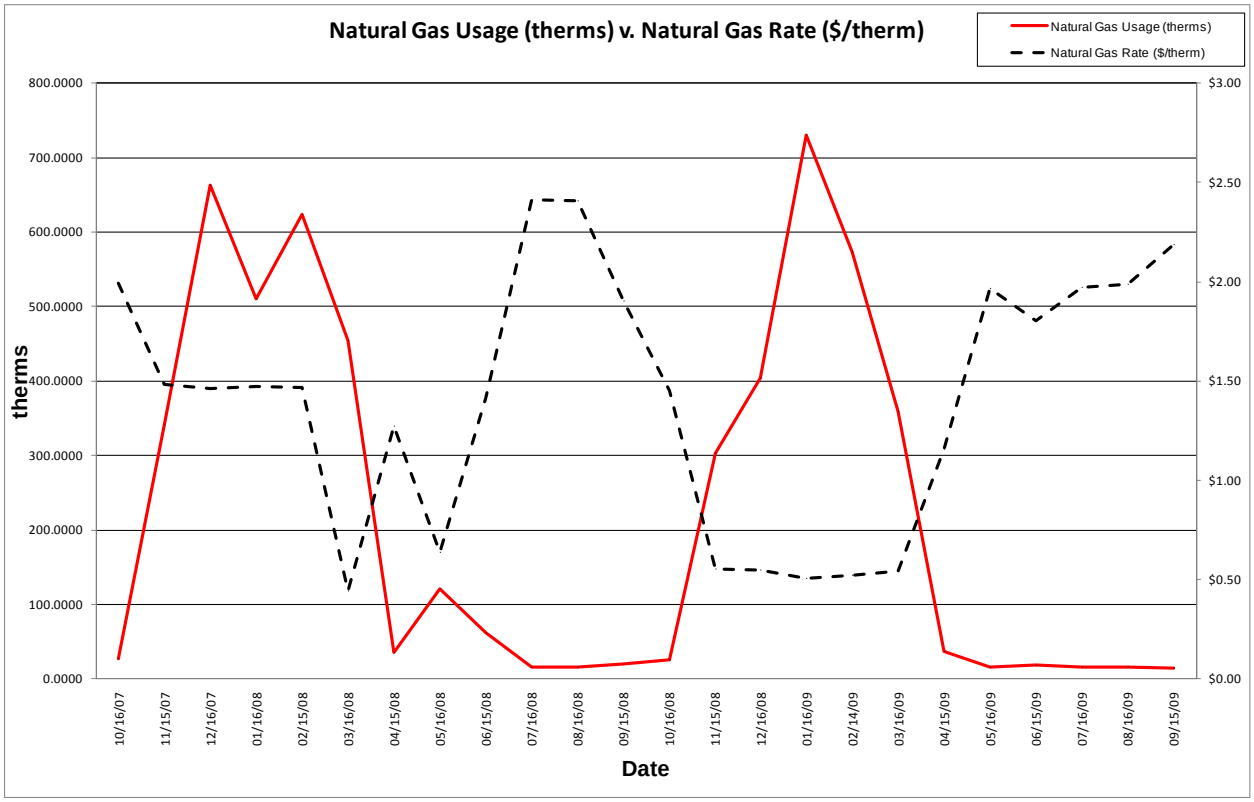
Appendix B contains a complete list of third party energy suppliers.



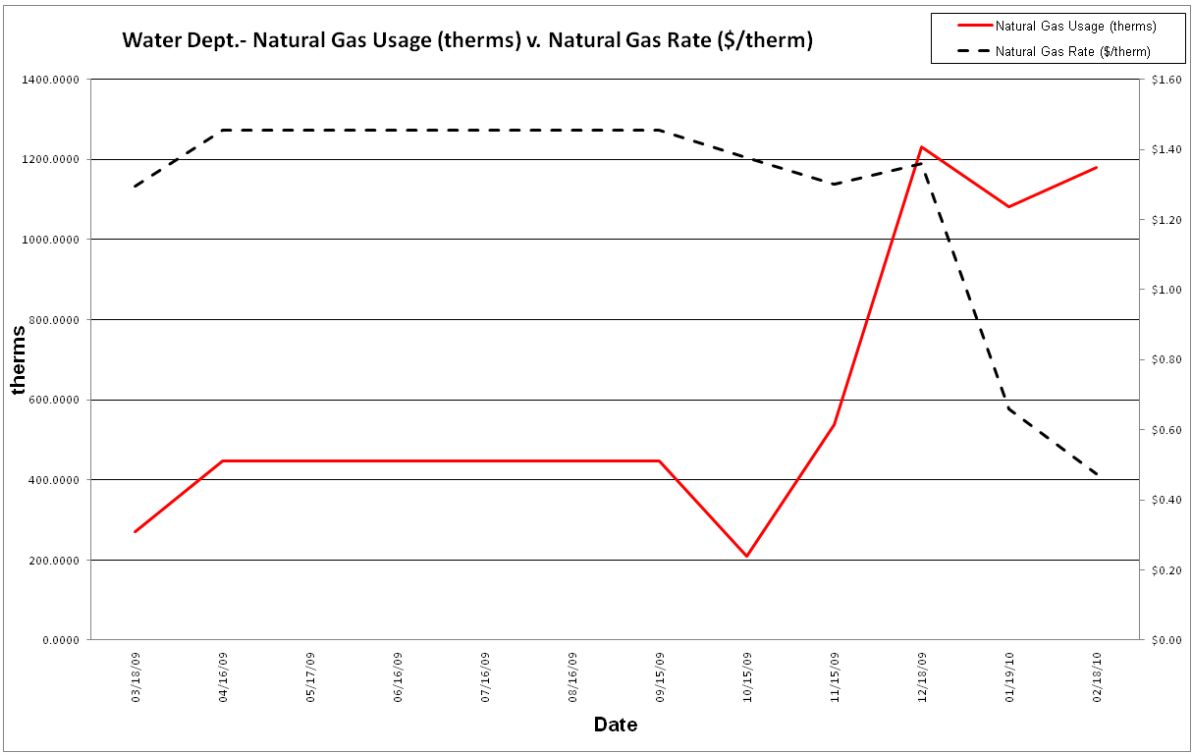
Electricity prices rise after electricity usage rises



Electricity prices rise after electricity usage rises



Natural gas prices rise after usage rises



Natural Gas rates generally fluctuate with usage

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions, 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.

LIGHTING ANALYSIS

Borough of Beachwood
Department of Public Works
1150 Beachwood Blvd.

BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

Upgrade Code	Upgrade Description	Existing Fixture	Existing Watts	Proposed Fixture	Proposed Watts	Lighting Total # of Upgrades	Lighting Cost per Upgrade ($)	Lighting SmartStart Rebate per Upgrade
1	(2) 34W T12 Lamps, Magnetic Ballast / Retrofit with (2) 28W Lamps, Elc. Basllast	2L4' EE/STD	80	2L4' T8/ELEC LO	55	13	$75.00	$15.00
2	60W Inc / Replace with 26W CF	60W Inc	60	26W CF	26	8	$8.00	$0.00
3	(4) 34W T12 lamps, Magnetic Ballast / Delamp and retrofit with with (2) 28W Lamps, Elc. Basllast, new reflector	4L4' EE/STD	160	2L4' T8/ELEC LO	55	19	$100.00	$30.00
4	100W Inc / Replace with 32W CF	100W Inc	100	32W CF	32	1	$10.00	$0.00
5	14W CF	14W CF	14	No Upgrade	14	1	$0.00	$0.00
6	(2) 32W T8 Lamps, Elc.Ballast	2L4' T8/ELEC	61	No Upgrade	61	0	$0.00	$0.00
7	(1) T9 Circline Lamp	1L6" (DIA) EE/ELEC	26	No Upgrade	26	1	$0.00	$0.00
8	(3) 34W T12 lamps, Magnetic Ballast / Retrofit with with (3) 28W Lamps, Elc. Basllast	3L4' EE/STD	130	3L4' T8/ELEC LO	79	2	$80.00	$15.00
9	Exit Sign	Exit Inc	15	LED	2	4	$0.00	$0.00
10	(2) 34W T12 U-Tube Lamps, Magnetic Ballast / Retrofit with (2) 28W U-Tube Lamps, Elc. Basllast	2L22" STD/STD	94	2L22"	62	8	$60.00	$0.00
11	(1) 34W T12, Magnetic Ballast / Retrofit with (1) 28W T8, Elec. Ballast	1L4' EE/STD	50	1L4' T8/ELEC LO	28	2	$45.00	$15.00
12	(3) 32W T8, Elec. Ballast	3L4' T8/ELEC	89	No Upgrade	89	1	$0.00	$0.00
13	(2) 32W T8 U-Tube Lamps, Elc.Ballast	2L22"	62	No Upgrade	62	2	$0.00	$0.00

Variables:

$0.17	Avg. Electric Rate ($/kWh)
	Avg. Demand Rate ($/kW)
2080	Operating Hours/Year
8	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Existing Fixture	Existing Qty.	Existing Watts	Existing Foot Candles	Proposed Fixture	Proposed Qty.	Proposed Watts	kW Reduction	Lighting Energy Savings, kWh	Lighting Cost ($)	Lighting Savings ($)	Lighting Payback (yrs)	Controls Type	Controls Qty.	Occupancy Sensors (ONLY) Energy Savings, kWh	Occupancy Sensors (ONLY) Cost ($)	Occupancy Sensors (ONLY) Savings ($)	Occupancy Sensors (ONLY) Payback (yrs)	SmartStart Rebate Lighting	SmartStart Rebate Sensors	Lighting & Occupancy Sensors Energy Savings, kWh	Lighting & Occupancy Sensors Post-Rebate Cost ($)	Lighting & Occupancy Sensors Savings ($)	Lighting & Occupancy Sensors Payback (yrs)
TOTALS							6085				2971	3.114	7370	$3,679.00	$1,252.94	2.9			0	$0.00	$0.00		$825	$0	7370	$2,854.00	$1,252.94	2.3
1		**DPW Main**																										
2	10	Back Office	9	2340	2L22" STD/STD	2	188		2L22"	2	124	0.064	150	$120.00	$25.46	4.7			0	$0	$0.00		$0	$0	150	$120.00	$25.46	4.7
3	2	Back Office	9	2340	60W Inc	4	240		26W CF	4	104	0.136	318	$32.00	$54.10	0.6			0	$0	$0.00		$0	$0	318	$32.00	$54.10	0.6
4	2	Back Office	9	2340	60W Inc	2	120		26W CF	2	52	0.068	159	$16.00	$27.05	0.6			0	$0	$0.00		$0	$0	159	$16.00	$27.05	0.6
5	3	Office	9	2340	4L4' EE/STD	1	160		2L4' T8/ELEC LO	1	55	0.105	246	$100.00	$41.77	2.4			0	$0	$0.00		$30	$0	246	$70.00	$41.77	1.7
6	3	Office	9	2340	4L4' EE/STD	6	960		2L4' T8/ELEC LO	6	330	0.63	1474	$600.00	$250.61	2.4			0	$0	$0.00		$180	$0	1,474	$420.00	$250.61	1.7
7	4	Restroom	9	2340	100W Inc	1	100		32W CF	1	32	0.068	159	$10.00	$27.05	0.4			0	$0	$0.00		$0	$0	159	$10.00	$27.05	0.4
8	13	Closet	9	2340	2L22"	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0	$0.00		$0	$0	0	$0.00	$0.00	
9	9	Enterance	9	2340	Exit Inc	1	15		LED	1	2	0.013	30	$0.00	$5.17	0.0			0	$0	$0.00		$0	$0	30	$0.00	$5.17	0.0
10	3		9	2340	4L4' EE/STD	2	320		2L4' T8/ELEC LO	2	110	0.21	491	$200.00	$83.54	2.4			0	$0	$0.00		$60	$0	491	$140.00	$83.54	1.7
11	10	Garage	9	2340	2L22" STD/STD	6	564		2L22"	6	372	0.192	449	$360.00	$76.38	4.7			0	$0	$0.00		$0	$0	449	$360.00	$76.38	4.7
12	9		9	2340	Exit Inc	1	15		LED	1	2	0.013	30	$0.00	$5.17	0.0			0	$0	$0.00		$0	$0	30	$0.00	$5.17	0.0
13	1	Stairway	9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
14	5		9	2340	14W CF	1	14		No Upgrade	1	14	0	0	$0.00	$0.00				0	$0	$0.00		$0	$0	0	$0.00	$0.00	
15	1	Lounge	9	2340	2L4' EE/STD	2	160		2L4' T8/ELEC LO	2	110	0.05	117	$150.00	$19.89	7.5			0	$0	$0.00		$30	$0	117	$120.00	$19.89	6.0
16	3		9	2340	4L4' EE/STD	1	160		2L4' T8/ELEC LO	1	55	0.105	246	$100.00	$41.77	2.4			0	$0	$0.00		$30	$0	246	$70.00	$41.77	1.7
17	3	Office	9	2340	4L4' EE/STD	1	160		2L4' T8/ELEC LO	1	55	0.105	246	$100.00	$41.77	2.4			0	$0	$0.00		$30	$0	246	$70.00	$41.77	1.7
18	1		9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
19	12	Restroom	9	2340	3L4' T8/ELEC	1	89		No Upgrade	1	89	0	0	$0.00	$0.00				0	$0	$0.00		$0	$0	0	$0.00	$0.00	
20	1	Office	9	2340	2L4' EE/STD	2	160		2L4' T8/ELEC LO	2	110	0.05	117	$150.00	$19.89	7.5			0	$0	$0.00		$30	$0	117	$120.00	$19.89	6.0
21	11	Garage	9	2340	1L4' EE/STD	1	50		1L4' T8/ELEC LO	1	28	0.022	51	$45.00	$8.75	5.1			0	$0	$0.00		$15	$0	51	$30.00	$8.75	3.4
22	1	Garage	9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
23		**Water Dept.**																										
24	1	Kitchen	9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
25	1	Locker Room	9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
26	1	Work Room	9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
27	1		9	2340	2L4' EE/STD	1	80		2L4' T8/ELEC LO	1	55	0.025	59	$75.00	$9.95	7.5			0	$0	$0.00		$15	$0	59	$60.00	$9.95	6.0
28	11		9	2340	1L4' EE/STD	1	50		1L4' T8/ELEC LO	1	28	0.022	51	$45.00	$8.75	5.1			0	$0	$0.00		$15	$0	51	$30.00	$8.75	3.4
29	2		9	2340	60W Inc	1	60		26W CF	1	26	0.034	80	$8.00	$13.53	0.6			0	$0	$0.00		$0	$0	80	$8.00	$13.53	0.6
30	7		9	2340	1L6" (DIA) EE/EL	1	26		No Upgrade	1	26	0	0	$0.00	$0.00				0	$0	$0.00		$0	$0	0	$0.00	$0.00	
31	9	Locker Room	9	2340	Exit Inc	1	15		LED	1	2	0.013	30	$0.00	$5.17	0.0			0	$0	$0.00		$0	$0	30	$0.00	$5.17	0.0
32	8	Chlorine room	9	2340	3L4' EE/STD	1	130		3L4' T8/ELEC LO	1	79	0.051	119	$80.00	$20.29	3.9			0	$0	$0.00		$15	$0	119	$65.00	$20.29	3.2
33	2	Clorine Pump Room	9	2340	60W Inc	1	60		26W CF	1	26	0.034	80	$8.00	$13.53	0.6			0	$0	$0.00		$0	$0	80	$8.00	$13.53	0.6
34	3	Tank Room	9	2340	4L4' EE/STD	8	1280		2L4' T8/ELEC LO	8	440	0.84	1966	$800.00	$334.15	2.4			0	$0	$0.00		$240	$0	1,966	$560.00	$334.15	1.7
35	1	Generator Room	9	2340	2L4' EE/STD	2	160		2L4' T8/ELEC LO	2	110	0.05	117	$150.00	$19.89	7.5			0	$0	$0.00		$30	$0	117	$120.00	$19.89	6.0
36	8	Workshop	9	2340	3L4' EE/STD	1	130		3L4' T8/ELEC LO	1	79	0.051	119	$80.00	$20.29	3.9			0	$0	$0.00		$15	$0	119	$65.00	$20.29	3.2
37	9	Exit Sign	24	8760	Exit Inc	1	15		LED	1	2	0.013	114	$0.00	$19.36	0.0			0	$0	$0.00		$0	$0	114	$0.00	$19.36	0.0

Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
American Powernet Management, LP	(877) 977-2636
437 North Grove St.	www.americanpowernet.com
Berlin, NJ 08009	
BOC Energy Services, Inc.	(800) 247-2644
575 Mountain Avenue	www.boc.com
Murray Hill, NJ 07974	
Commerce Energy, Inc.	(800) 556-8457
4400 Route 9 South, Suite 100	www.commerceenergy.com
Freehold, NJ 07728	
ConEdison Solutions	(888) 665-0955
535 State Highway 38	www.conedsolutions.com
Cherry Hill, NJ 08002	
Constellation NewEnergy, Inc.	(888) 635-0827
900A Lake Street, Suite 2	www.newenergy.com
Ramsey, NJ 07446	
Credit Suisse, (USA) Inc.	(212) 538-3124
700 College Road East	www.creditsuisse.com
Princeton, NJ 08450	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
FirstEnergy Solutions	(800) 977-0500
300 Madison Avenue	www.fes.com
Morristown, NJ 07926	
Glacial Energy of New Jersey, Inc.	(877) 569-2841
207 LaRoche Avenue	www.glacialenergy.com
Harrington Park, NJ 07640	
Metro Energy Group, LLC	(888) 536-3876
14 Washington Place	www.metroenergy.com
Hackensack, NJ 07601	
Integrys Energy Services, Inc.	(877) 763-9977
99 Wood Ave, South, Suite 802	www.integrysenergy.com
Iselin, NJ 08830	
Liberty Power Delaware, LLC	(866) 769-3799
Park 80 West Plaza II, Suite 200	www.libertypowercorp.com
Saddle Brook, NJ 07663	
Liberty Power Holdings, LLC	(800) 363-7499
Park 80 West Plaza II, Suite 200	www.libertypowercorp.com
Saddle Brook, NJ 07663	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main St.	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
Sempra Energy Solutions	(877) 273-6772
581 Main Street, 8th Floor	www.semprasolutions.com
Woodbridge, NJ 07095	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Strategic Energy, LLC	(888) 925-9115
55 Madison Avenue, Suite 400	www.sel.com
Morristown, NJ 07960	
Suez Energy Resources NA, Inc.	(888) 644-1014
333 Thornall Street, 6th Floor	www.suezenergyresources.com
Edison, NJ 08837	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	

Third Party Gas Suppliers for Elizabethtown Gas Co. Service Territory	Telephone & Web Site
Cooperative Industries	(800) 628-9427
412-420 Washington Avenue	www.cooperativenet.com
Belleville, NJ 07109	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
Gateway Energy Services Corp.	(800) 805-8586
44 Whispering Pines Lane	www.gesc.com
Lakewood, NJ 08701	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	
Great Eastern Energy	(888) 651-4121
116 Village Riva, Suite 200	www.greateastern.com
Princeton, NJ 08540	
Glacial Energy of New Jersey, Inc.	(877) 569-2841
207 LaRoche Avenue	www.glacialenergy.com
Harrington Park, NJ 07640	
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
Intelligent Energy	(800) 724-1880
2050 Center Avenue, Suite 500	www.intelligentenergy.org
Fort Lee, NJ 07024	
Metromedia Energy, Inc.	(877) 750-7046
6 Industrial Way	www.metromediaenergy.com
Eatontown, NJ 07724	
MxEnergy, Inc.	(800) 375-1277
510 Thornall Street, Suite 270	www.mxenergy.com
Edison, NJ 08837	
NATGASCO (Mitchell Supreme)	(800) 840-4427
532 Freeman Street	www.natgasco.com
Orange, NJ 07050	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main Street	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Woodruff Energy	(800) 557-1121
73 Water Street	www.woodruffenergy.com
Bridgeton, NJ 08302	