



Steven Winter Associates, Inc.
Architects and Engineers

293 Route 18 South, Suite 330
East Brunswick, NJ 08816
www.swinter.com

Telephone: (866) 676-1972
E-mail: swinter@swinter.com

June 09, 2010

**Local Government Energy Program
Energy Audit Report**

For

*Department of Public Works Building
339 Roosevelt Avenue
Carteret, NJ 07008*

Project Number: LGEA24



Image attained from Microsoft via Bing.com

TABLE OF CONTENTS

INTRODUCTION.....	3
EXECUTIVE SUMMARY.....	4
1. HISTORIC ENERGY CONSUMPTION.....	7
1.1. ENERGY USAGE AND COST ANALYSIS.....	7
1.2. UTILITY RATE.....	8
1.3. ENERGY BENCHMARKING.....	8
2. FACILITY AND SYSTEMS DESCRIPTION.....	11
2.1. BUILDING CHARACTERISTICS.....	11
2.2. BUILDING OCCUPANCY PROFILES.....	11
2.3. BUILDING ENVELOPE.....	11
2.3.1. EXTERIOR WALLS.....	11
2.3.2. ROOF.....	11
2.3.3. BASE.....	11
2.3.4. WINDOWS.....	11
2.3.5. EXTERIOR DOORS.....	11
2.3.6. BUILDING AIR TIGHTNESS.....	12
2.4. HVAC SYSTEMS.....	12
2.4.1. HEATING.....	12
2.4.2. COOLING.....	12
2.4.3. VENTILATION.....	12
2.4.4. DOMESTIC HOT WATER.....	12
2.5. ELECTRICAL SYSTEMS.....	12
2.5.1. LIGHTING.....	12
2.5.2. APPLIANCES AND PROCESS.....	13
2.5.3. ELEVATORS.....	13
2.5.4. OTHER ELECTRICAL SYSTEMS.....	13
3. EQUIPMENT LIST.....	13
4. ENERGY CONSERVATION MEASURES.....	14
5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES.....	20
5.1. EXISTING SYSTEMS.....	20
5.2. SOLAR PHOTOVOLTAIC.....	20
5.3. SOLAR THERMAL COLLECTORS.....	20
5.4. COMBINED HEAT AND POWER.....	20
5.5. GEOTHERMAL.....	20
5.6. WIND.....	20
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES.....	20
6.1. ENERGY PROCUREMENT STRATEGIES.....	23
7. METHOD OF ANALYSIS.....	24
7.1. ASSUMPTIONS AND METHODS.....	24
7.2. DISCLAIMER.....	24
APPENDIX A: LIGHTING STUDY.....	26
APPENDIX B: THIRD PARTY ENERGY SUPPLIERS (ESCOs).....	27

INTRODUCTION

On November 13, 2009 and January 7, 2010, 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 Building. The building is located at 339 Roosevelt, Carteret, NJ 07008, in Middlesex County. The current conditions and energy-related information were collected in order to analyze the implementation of energy conservation measures for the building.

The one-story facility, built in 2008 is 6,420 square feet in area. This building includes the Department of Public Works administrative offices as well as the Municipal Garage. The building is open 40 hours a week, daily from 7:00am to 3:00pm

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 Local Government Energy Audit (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 Department of Public Works, located at 339 Roosevelt Ave, Carteret, New Jersey 07008.

Based on the field visits performed by SWA and BSG-PMK staff on November 13, 2009 and January 7, 2010 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, March, 2008 through February, 2009, the Department of Public Works facility consumed a total of 50,840 kWh of electricity for a total cost of \$9,072, and 3,105 therms of natural gas for a total cost of \$3,413.

With electricity and fossil fuel combined, the building consumed 484.02 MMBtus of energy at a total cost of \$12,485.

SWA/BSG-PMK has entered energy information about the Department of Public Works 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. 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.

The building performance rating could not be determined because the electric-utility consumption data provided is greater than 120 days old.

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 Carteret to continue entering utility data in *Energy Star Portfolio Manager* in order to track whether normalized source energy use over time.

(Refer to Section 1.3 for Energy Star Rating)

Category I Recommendations: Capital Improvement Measures

- 1) Based on BSG-PMK's survey of the facility, no capital improvements are recommended, as the building is only two years old.

Category II Recommendations: Operations and Maintenance

- 1) Based on BSG-PMK's survey of the facility, no operations and maintenance measures are recommended, as the building is only two years old.

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

At this time, SWA/BSG-PMK highly recommends a total of two (2) Energy Conservation Measures (ECMs) for the DPW which are summarized in the following Table 1. The total investment cost for these ECMs, without incentives, is **\$3,335**, and with incentives, is **\$3,205**. SWA/BSG-PMK estimates a first year savings of **\$4,542** with a simple payback of **4.9 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the DPW building by **4,455 lbs of CO₂**. SWA also recommends that the Borough of Carteret 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 \$ 0.03/kWh, which would have equated to \$1,446.00 for the past 12 months

There are various incentives that the Borough of Carteret 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 the DPW in the previous year was 24.8 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	kBtus/gal, 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 Upgrades	Empirical Data	\$535	\$80	\$455	1,623	0.7	0	0.86	\$0.00	\$292	15	\$3,437	1.56	655%	44%	64%	\$2,651	2,223
TOTAL			\$535	\$80	\$455	1,623	0.7	0	0.86	\$0.00	\$292	-	\$3,437	1.56	-	-	-	\$2,651	2,223

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	kBtus/gal, 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	Convert Electric Water Heater to Natural Gas	Similar Projects	\$2,800	\$50	\$2,750	2,919	1.2	-151	-0.80	\$0.00	\$359	13	\$3,774	7.65	37%	3%	9%	\$1,072	2,232
TOTAL			\$2,800	\$50	\$2,750	2,919	1.2	-151	-0.80	\$0.00	\$359	-	\$3,774	7.65	-	-	-	\$1,072	2,232

ROI: Return on Investment (%)

Assumptions:

Discount rate:

3.2% per DOE FEMP guidelines

Electricity rate:

\$0.18 \$/kWh

Energy price escalation rate:

0% per DOE FEMP guidelines

Gas rate:

\$1.10 \$/therm

Area of Building (SF)

6,420

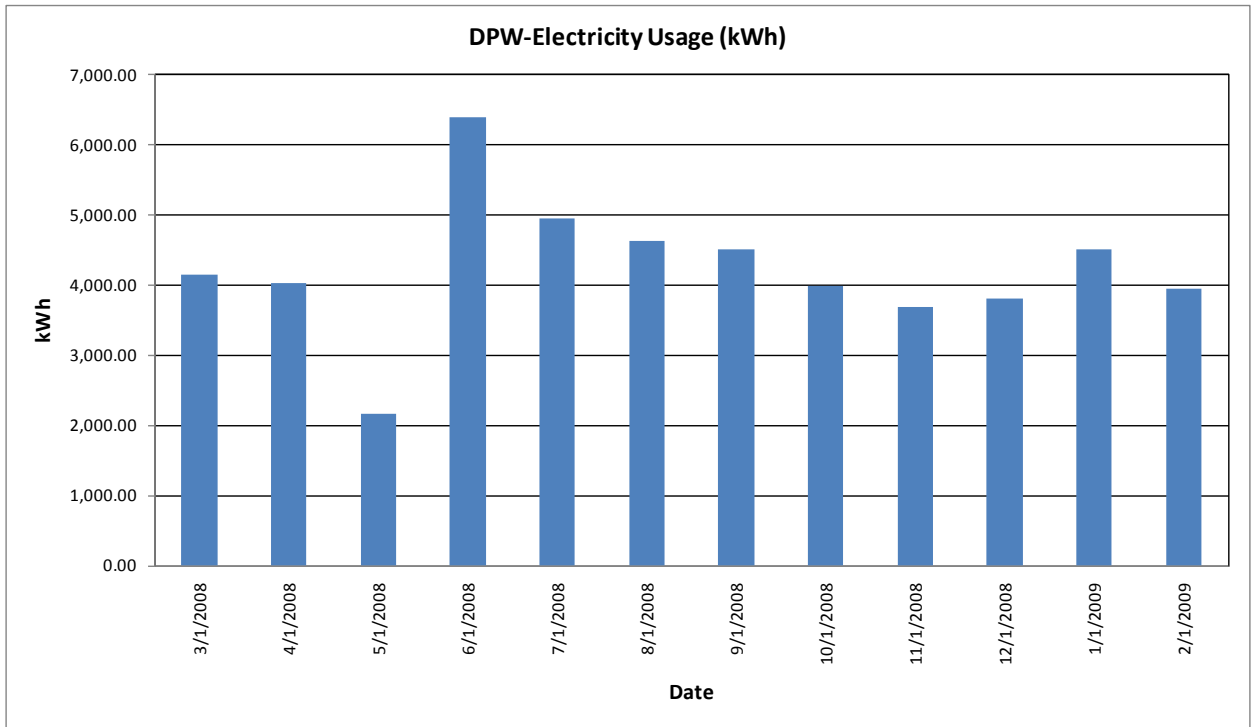
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy usage and cost analysis

SWA/BSG-PMK analyzed utility bills from March, 2008 through February, 2009 that were received from the utility companies supplying the Department of Public Works with electric and natural gas.

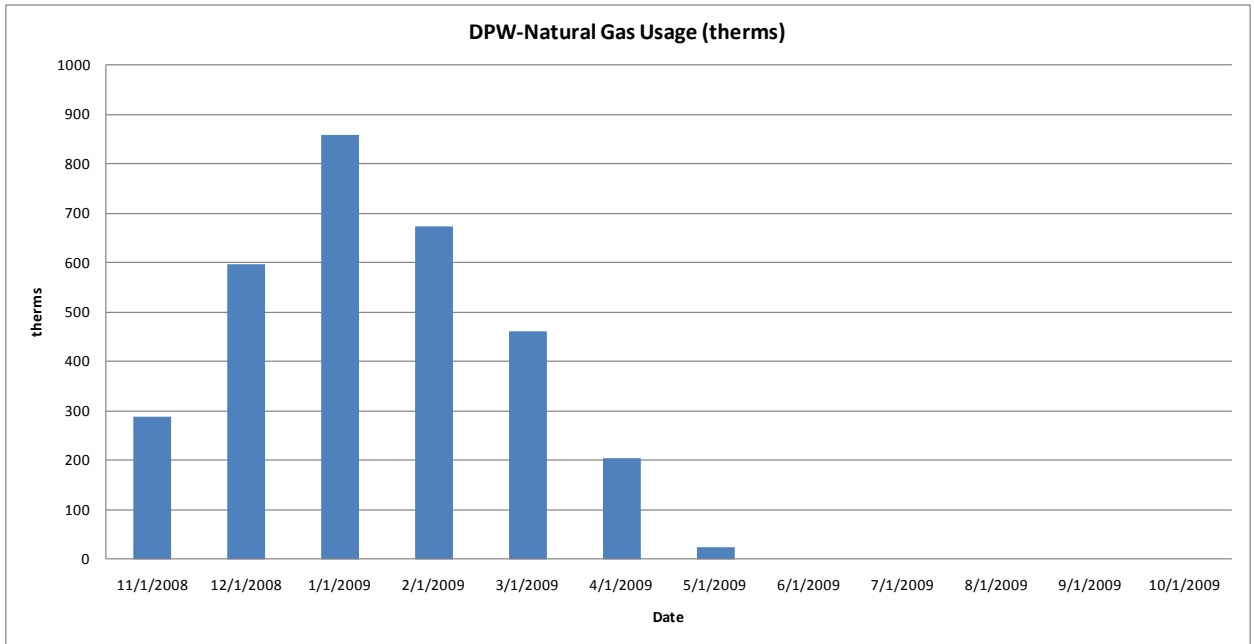
Electricity - The Department of Public Works building is currently served by one electric meter and purchases electricity from Public Service Electric & Gas at **an average rate of \$0.18/kWh** based on 12 months of utility bills from March, 2008 through February, 2009. The building purchased **50,840 kWh or \$9,072 worth of electricity** during that time span.

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



Natural Gas - The Department of Public Works is currently served by one natural gas meter and buys gas from Elizabethtown Gas at **an average rate of \$1.10/therm** based on 12 months of utility bills from December, 2008 through November, 2009. The building purchased **3,105 therms or \$3,413 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 December, 2008 through November, 2009:



1.2. Utility rate

The Department of Public Works currently purchases electricity from Public Service Electric & Gas for electricity use (kWh) with a separate (kW) demand charge. The complex currently pays an average rate of approximately \$0.18/kWh based on the 12 months of utility bills of March, 2008 through February, 2009.

The Department of Public Works currently purchases natural gas supply and transmission from Elizabethtown Gas at an average aggregated rate of \$1.10/therm based on 12 months of utility bills from December, 2008 through November, 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. BSG-PMK and SWA recommend that the Borough maintain the Portfolio Manager account at the link below. As the account is maintained, BSG-PMK and SWA can share with the Borough and allow future data to be added and tracked using the benchmarking tool.

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

Username: boroughofcarteret
Password: carteret

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 calculated Site Energy Use Intensity is 75.4 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 0.1 kBtu/ft²yr, which when implemented would lower the buildings energy consumption.



STATEMENT OF ENERGY PERFORMANCE

Department of Public Works

Building ID: 2035808
 For 12-month Period Ending: October 31, 2009¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

Facility
 Department of Public Works
 339 Roosevelt Ave
 Carteret, NJ 07008

Facility Owner
 Borough of Carteret
 61 Cooke Ave
 Carteret, NJ 07008

Primary Contact for this Facility
 Anthony Neibert
 61 Cooke Ave
 Carteret, NJ 07008

Year Built: 2008
Gross Floor Area (ft²): 6,420

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	173,466
Natural Gas (kBtu) ⁴	310,550
Total Energy (kBtu)	484,016

Energy Intensity⁵

Site (kBtu/ft ² /yr)	75
Source (kBtu/ft ² /yr)	141

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	43
---	----

Electric Distribution Utility

Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	-6%
Building Type	Service (Vehicle Repair/Service, Postal Service)

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.

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 6 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.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Department of Public Works facility was built in 2008. The one-story building has a total area of 6,420 square feet. The Department of Public Works facility houses the municipal vehicle repair garage as well as administrative offices

2.2. Building occupancy profiles

The building is open from 7:00am to 3:00pm Monday through Friday, 40 hours a week. There are approximately 12 DPW employees.

2.3. Building envelope

2.3.1. Exterior walls

The exterior walls are constructed from split-face block and metal wall panel system. The interior of the walls are unfinished in the garage bay but do have 6" of insulation. The interior of the walls are finished in the office portion of the building with gypsum wall board. Insulation in the building is in good condition.



2.3.2. Roof

The standing-seam, shed roof is constructed from steel and the insulation is in good condition.



2.3.3. Base

The base of the building is a poured concrete slab on-grade.

2.3.4. Windows

There are approximately 15 double-pane aluminum framed windows on the building. All are in good condition.

2.3.5. Exterior doors

The exterior doors are in good condition. There are ten insulated overhead doors and five aluminum regular doors.

2.3.6. Building air tightness

The building is air tight and there are no occupant complaints or signs of outside air infiltration.

2.4. HVAC systems

2.4.1. Heating

The DPW's heating is generated by a 92.1%-efficient gas-fired furnace; its capacity could not be found. The unit, installed in 2007, was manufactured by Lennox and has model # C33-38B-2F-3. There is also a Lennox unit heater and Gordon Ray radiant heating tubes in the garage, all without accessible nameplates.

2.4.2. Cooling

Only the upstairs lounge area is cooled. A cooling coil in the Lennox furnace is served by a 3-ton, high-efficiency condensing unit, with a 14.5 SEER and model # XC-036-230-02.



2.4.3. Ventilation

Ventilation is provided by exhaust fans on the roof, doors, and windows; all of which are in good working order.

2.4.4. Domestic Hot Water

Water is heated by a 40 gallon, 4.5 kW electric water heater, which is about 3 years old. The heater is a Rheem unit with model # 82V40-2.

Category III Recommendation – ECM #2: Replace the current water heater with a 40 gallon, gas-fired unit. Natural gas is much more cost efficient source of energy than electricity, and due to the fact that the gas-fired boiler is in the same room as the water heater, only a few feet of piping are needed to bring gas to the unit.

2.5. Electrical systems

2.5.1. 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 \$65.57 based on the current \$0.18/kWh and the current occupancy schedule. Implementation of this ECM will cost approximately \$430.00. Currently the Board of Public Utilities (BPU) would offer an estimated rebate of \$75, yielding a net cost of \$355.00 for this project. The payback on this ECM would about 5.4 years.

Category III Recommendation - ECM #1: Recommend upgrading all T-12 lighting fixtures with magnetic ballasts to T-8 fixtures with electronic ballasts, as well as various other lighting upgrades outlined in Appendix A. Also recommend installing lighting sensors to certain areas where lights typically remain lit when unoccupied for long periods of time.

Refer to Appendix A for further details.

2.5.2. Appliances and process

There is a coffee maker, a refrigerator, a microwave, and other cooking equipment in the lounge area.

2.5.3. Elevators

This facility does not have an elevator.

2.5.4. Other electrical systems

There are currently no other significant energy impacting electrical systems installed at the DPW.

3. EQUIPMENT LIST

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Radiant heating tubes; nameplates not accessible	Garage, suspended from ceiling	Gordon Ray (nameplate not accessible)	Natural Gas	Garage	approx. 2006	85%
Heating	Unit heater; nameplate not accessible	Upstairs	Lennox (nameplate not accessible)	Natural Gas	Upstairs	Unknown (good condition)	Unknown
Heating/ Cooling	92.1% efficient gas furnace, capacity not listed; equipped with cooling coil for condensing unit	Upstairs	Lennox Elite M# C33-38B-2F-3	Natural Gas	Upstairs	2007	90%
Domestic Hot Water	Electric domestic water heater; 40 gallons, 4.5 kW	Upstairs	Rheem M# 82V40-2	Electricity	Upstairs	2007	87%
Cooling	3-ton high-efficiency condensing unit, 14.5 SEER	Outside	Lennox Elite XC13-036-230-02	Electricity	Upstairs	2007	80%

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 this building, SWA and BSG-PMK have separated the investment opportunities into three categories of recommendations:

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

- 1) Based on BSG-PMK’s survey of the facility, no capital improvements are recommended, as the building is only two years old.

Category II Recommendations: Operations and Maintenance

- 1) Based on BSG-PMK’s survey of the facility, no operations and maintenance measures are recommended, as the building is only two years old.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM #	ECM Description
1	Lighting Upgrades and Occupancy Sensors
2	Convert Electric Water Heater to Natural Gas

ECM#1: Lighting Upgrades & Occupancy Sensors

Description:

Lighting at the Carteret DPW Facility consists primarily of energy efficient T-8 fluorescent lamps with electronic ballasts. There are some incandescent lamps which should be replaced with compact fluorescents and incandescent exit signs which should be retrofit with LED technology. Lighting replacement generally yields a very good payback, due to the fact that most lighting usage in commercial buildings is fairly high and the installation is relatively inexpensive.

The use of occupancy sensors, which is a lighting control that will turn off power to the lights when a room is not occupied, is also recommended. Rooms that were determined to be prime candidates for occupancy sensors are marked on the lighting spreadsheet (Appendix A).

Installation cost:

Estimated installed cost:

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	\$535.00	\$260.00	\$795.00
Rebate	\$80.00	\$105.00	\$185.00
Net Cost	\$455.00	\$155.00	\$610.00
Savings (kWh)	1,623	111	1,733
Savings (\$)	\$292.08	\$19.94	\$312.02
Payback	1.6	7.8	2.0

Source of cost estimate: RS Means/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	Thermus, 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 Upgrades	Empirical Data	\$535	\$80	\$455	1,623	0.7	0	0.86	\$0.00	\$292	15	\$3,437	1.56	655%	44%	64%	\$2,651	2,223

Assumptions:

The electric cost used in this ECM was \$0.18/kWh, which was the facilities average rate for the 12-month period ranging from March 1, 2008 through February 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 offers rebates for upgrading lighting fixtures and installing lighting controls. The total rebate this ECM qualifies for is \$185.

ECM #2: Convert Electric Water Heater to Natural Gas

Description:

Domestic hot water is provided by an electric water heater, which has a volume of 40 gallons. A natural gas unit would be much more cost-efficient. The current water heater is located in the same room as a gas-fired boiler, so switching to a gas-fired water heater is economically feasible.

Installation cost:

Estimated installed cost: Installation: \$2,800; rebates/incentives: \$50; total: \$2,750

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, \$	CO2 Reduced, lbs/yr
2	Convert Electric Water Heater to Natural Gas	Similar Projects	\$2,800	\$50	\$2,750	2,919	1.2	-151	-0.80	\$0.00	\$359	13	\$3,774	7.65	37%	3%	9%	\$1,072	2,232

Assumptions:

Using the facility's electricity bills from March, 2008 through February, 2009, it was determined that the cost of electricity is currently \$0.18/kWh. From November, 2008 through October, 2009, the cost of natural gas is \$1.10/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 and 0.62 for gas units. 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 Hot Water Heated	H2O Weight	Temperature Rise in °F	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	Cost per kWh	Actual Daily Cost to Heat	Actual Annual Cost to Heat
40	8.33	77	25,656	0.94	27,294	\$0.18	\$1.43	\$520.87

Natural Gas

Volume of Hot Water Heated	H2O Weight	Temperature Rise in °F	BTUs Required to Heat Water	Energy Factor	BTUs Purchased to Heat Water	Cost per Therm	Actual Daily Cost to Heat	Actual Annual Cost to Heat
40	8.33	77	25,656	0.62	41,381	\$1.10	\$0.45	\$166.01

Rebates/financial incentives:

This ECM qualifies for a New Jersey SmartStart rebate of \$50.

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, ARRA grants available through the NJ Office of Clean Energy, 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 pay 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 not be feasible at this location. The grounds do not provide enough area for a ground mounted installation. The roof is a standing seam steel roof that did not appear to be strong enough to support the additional weight of a roof mounted PV installation.

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

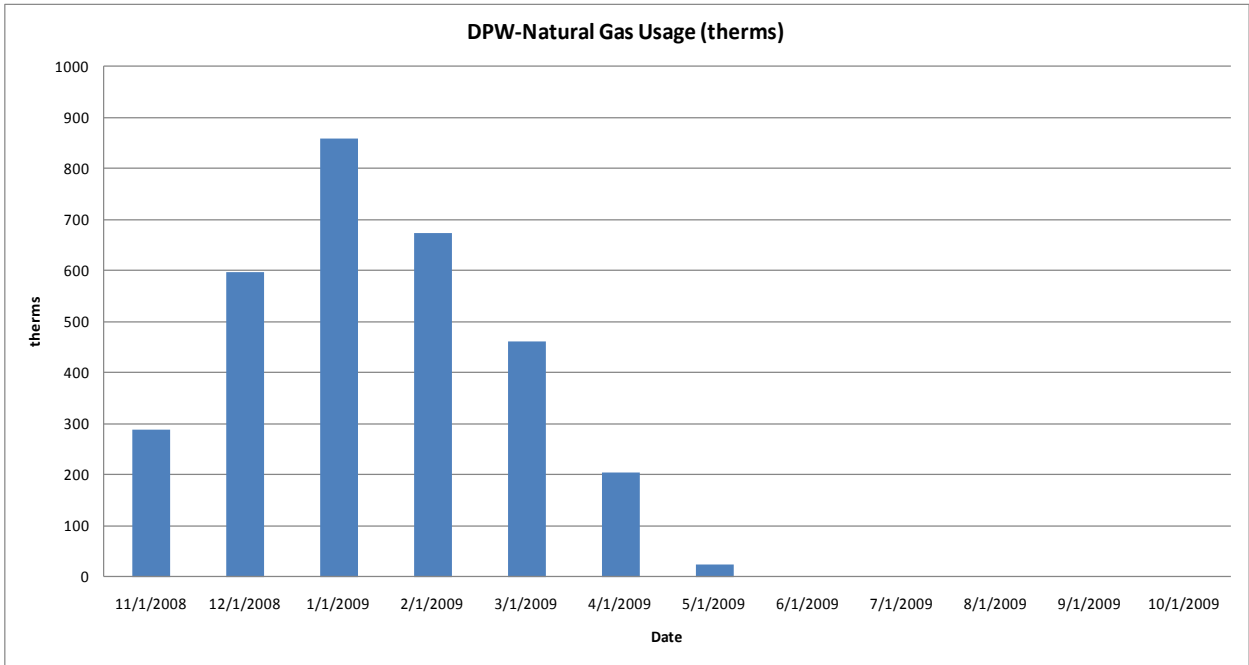
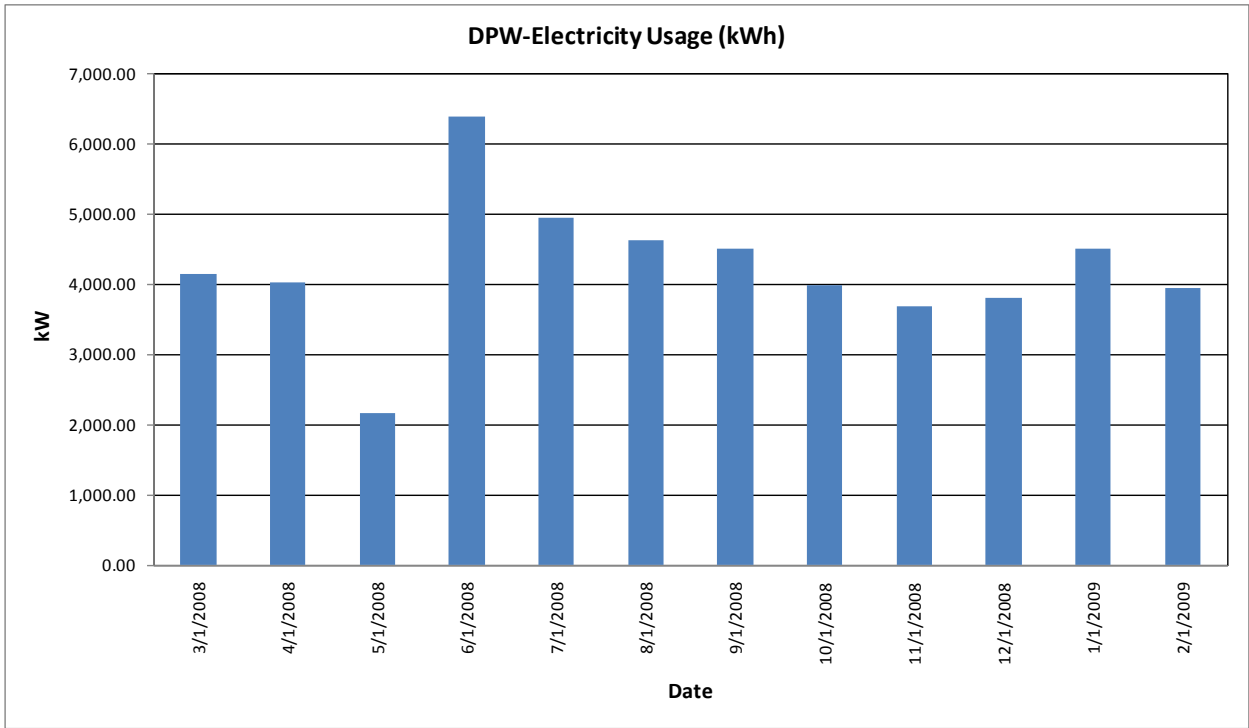
Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.

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

The average electrical peak demand for the facility during previous year was 21.1 kW and the maximum peak demand was 24.8 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows the electric demand (in kW) for the previous 12 months and the other two charts show electric (in kWh) and gas usage (in therms), respectively.

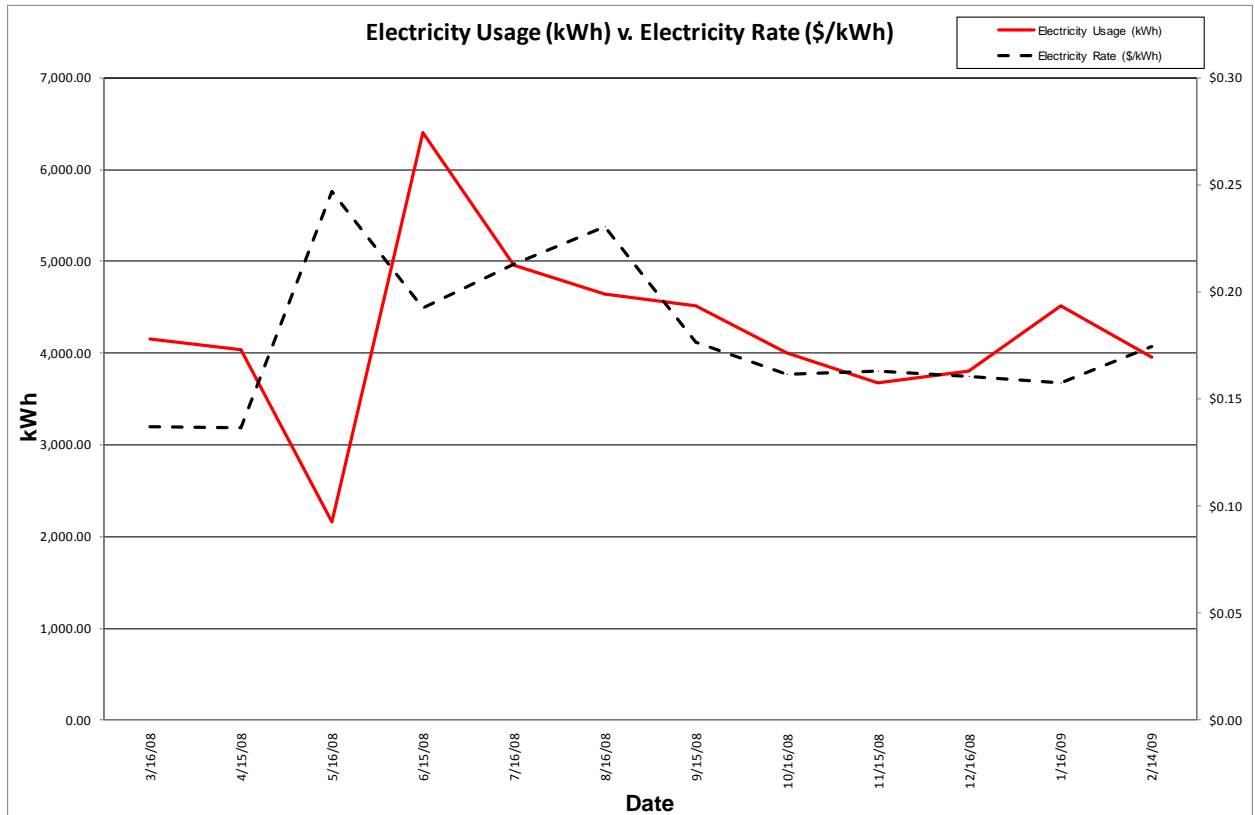


Currently, New Jersey commercial buildings of similar type pay \$0.150/kWh for electricity and \$1.55/therm for natural gas. The electricity rate for the building \$0.18/kWh, which means there is a potential cost savings of \$1,446. per year. The gas rate for the building is \$1.10 /therm which is better than the average gas cost. A small cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the

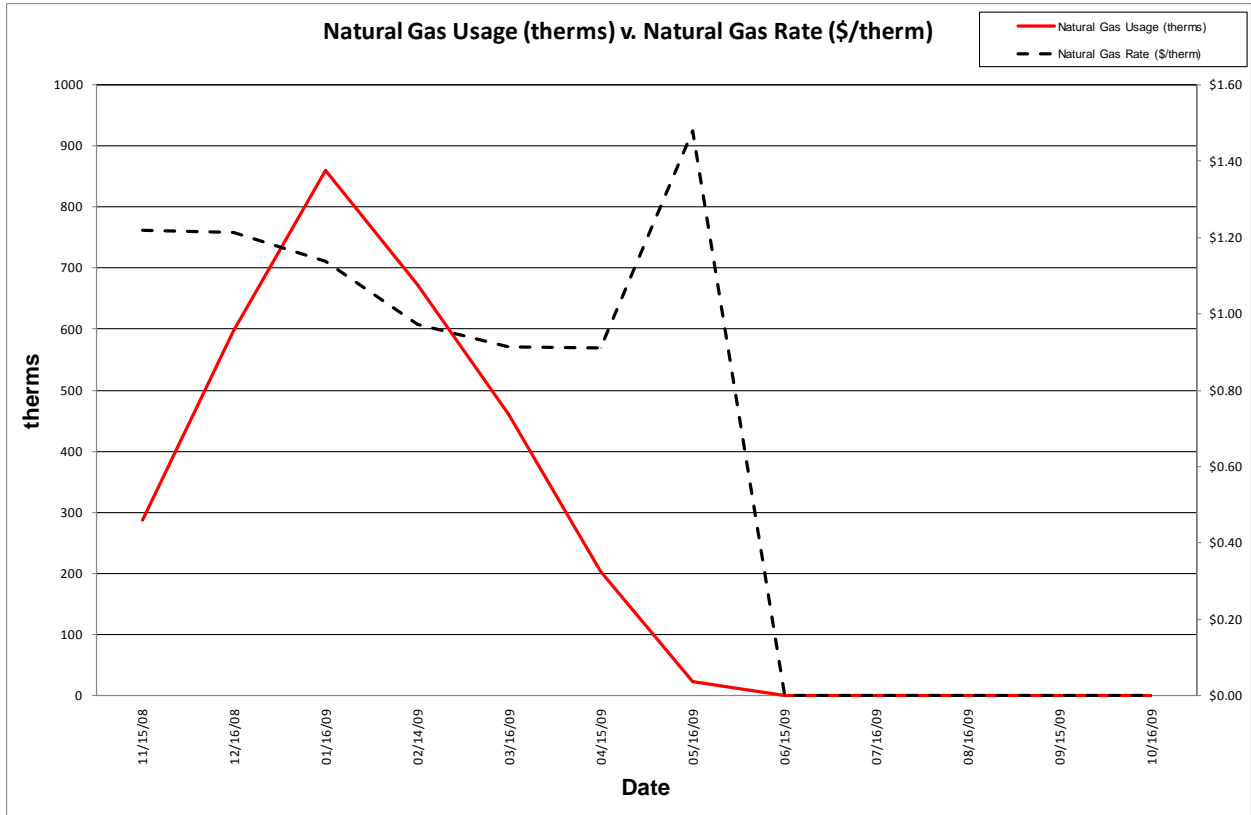
Borough of Carteret further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the building. Appendix B contains a complete list of third party energy suppliers for the Borough of Carteret service area.

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



Electricity prices reflect electricity usage



Natural gas prices fluctuate as expected with usage

7. METHOD OF ANALYSIS

7.1. Assumptions and methods

Energy modeling method: Spreadsheet-based calculation methods

Cost estimates: RS Means 2009 (Facilities Maintenance & Repair Cost Data)

RS Means 2009 (Building Construction Cost Data)

RS Means 2009 (Mechanical Cost Data)

Note: 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 Carteret
Department of Public Works
339 Roosevelt Avenue



Upgrade Code	Upgrade Description	Existing		Proposed		Lighting		
		Fixture	Watts	Fixture	Watts	Total # of Upgrades	Cost per Upgrade (\$)	SmartStart Rebate per Upgrade
1	(3) 4' 32W T8 Lamps, Electronic Ballast / No Upgrade	3L4' T8/ELEC	89	No Upgrade	89	18	\$0.00	\$0.00
2	250W MH / No Upgrade	250W MH/BALLAST	286	No Upgrade	286	18	\$0.00	\$0.00
3	(2) 32W T8 U-Tube Lamps, Electronic Ballast / No Upgrade	2L22"	62	No Upgrade	62	2	\$0.00	\$0.00
4	Incandescent Exit Sign	15W EXIT	15	LED	2	8	\$40.00	\$10.00
5	(2) 4' 32W T8 Lamps, Electronic Ballast / No Upgrade	2L4' T8/ELEC	61	No Upgrade	61	14	\$0.00	\$0.00
6	60W Incandescent / Replace with 23W Compact Fluorescent	60W INCANDESCENT	60	23W CF/SI	24	5	\$10.00	\$0.00
7	70W High Pressure Sodium Wall Pack	70W HPS/BALLAST	92	50W MH/BALLAST	72	2	\$60.00	\$0.00
8	Incandescent Flood	85W INCANDESCENT	85	26W CF/SI	28	3	\$15.00	\$0.00
9						0	\$0.00	\$0.00
10						0	\$0.00	\$0.00
11						0	\$0.00	\$0.00
12						0	\$0.00	\$0.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	\$535.00	\$260.00	\$795.00
Rebate	\$80.00	\$105.00	\$185.00
Net Cost	\$455.00	\$155.00	\$610.00
Savings (kWh)	1,623	111	1,733
Savings (\$)	\$292.08	\$19.94	\$312.02
Payback	1.6	7.8	2.0

Variables:

0.18	Avg. Electric Rate (\$/kWh)
	Avg. Demand Rate (\$/kW)
2000	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				Proposed				Lighting			Occupancy Sensors (ONLY)				Lighting & Occupancy Sensors							
					Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts	kW Reduction	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	SmartStart Rebate	Energy Savings, kWh	Post-Rebate Cost (\$)	Savings (\$)	Payback (yrs)		
Totals: 8587									8092	0.496	1623	\$535.00	\$292.08	1.6	111	\$260.00	\$19.94	13.0	\$80.00	\$105.00	1733	\$610.00	\$312.02	2.0			
1	1	Kitchen	8	2000	3L4' T8/ELEC	3	267		No Upgrade	3	267	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
2	1	Foyer	8	2000	3L4' T8/ELEC	1	89		No Upgrade	1	89	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
3	1	Office	8	2000	3L4' T8/ELEC	6	534		No Upgrade	6	534	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
4	2	Bay	10	2500	250W MH/BALLAST	18	5148		No Upgrade	18	5148	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
5	1	Bathroom	8	2000	3L4' T8/ELEC	1	89		No Upgrade	1	89	0	0	\$0.00	\$0.00	OSR	1	46	\$260.00	\$8.33	\$12	\$0.00	\$55.00	46	\$225.00	\$8.33	27.0
6	3		8	2000	2L22"	2	124		No Upgrade	2	124	0	0	\$0.00	\$0.00	OSR	64	\$0.00	\$11.61	0.0	\$0.00	\$70.00	64	-\$70.00	\$11.61	-6.0	
7	1	Hallway	16	4160	3L4' T8/ELEC	2	178		No Upgrade	2	178	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
8	1	Office	8	2000	3L4' T8/ELEC	2	178		No Upgrade	2	178	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
9	1	Office	8	2000	3L4' T8/ELEC	2	178		No Upgrade	2	178	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
10	1	Cbsert	1	260	3L4' T8/ELEC	1	89		No Upgrade	1	89	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
11	4	Inc Exit	24	8760	15W Exit	8	120		LED	8	16	0.104	911	\$320.00	\$163.99	2.0				\$80.00	\$0.00	911	\$240.00	\$163.99	1.5		
12	5		24	8760	2L4' T8/ELEC	14	854		No Upgrade	14	854	0	0	\$0.00	\$0.00					\$0.00	\$0.00	0	\$0.00	\$0.00			
13	6	Exterior Lights	7	1620	60W INCANDESCENT	5	300		23W CF/SI	5	120	0.18	320	\$50.00	\$58.97	0.8				\$0.00	\$0.00	320	\$50.00	\$58.97	0.8		
14	7		7	1620	70W HPS/BALLAST	2	184		50W MH/BALLAST	2	144	0.04	73	\$120.00	\$13.10	9.2				\$0.00	\$0.00	73	\$120.00	\$13.10	9.2		
15	8		7	1620	85W INCANDESCENT	3	255		26W CF/SI	3	84	0.171	311	\$45.00	\$56.02	0.8				\$0.00	\$0.00	311	\$45.00	\$56.02	0.8		

Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site	Third Party Gas Suppliers for Elizabethtown Gas Co. Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com	Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com	UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com	Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com	Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com	Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com	MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com	NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrusenergy.com	Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com	South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com	Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.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		
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com		
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.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		