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*June 09, 2010*

**Local Government Energy Program  
Energy Audit Report**

*For*

***Firehouse #2  
Pekola Terrace & Germak Ave  
Carteret, NJ 07008***

***Project Number: LGEA24***



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## **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 Firehouse #2 building. The building is located at the intersection of Pekola Terrace and Germak Drive, 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 1950 is 2,304 square feet in area. This building includes a lounge area and engine bays. The building is occupied 40 hours a 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 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 Firehouse #2, located at the intersection of Pekola Terrace and Germak Drive, 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 Firehouse #2 consumed a total of 33,252 kWh of electricity for a total cost of \$5,243, and 2,375 therms of natural gas for a total cost of \$4,013.

With electricity and fossil fuel combined, the building consumed 350.9 MMBtus of energy at a total cost of \$9,256.

SWA/BSG-PMK has entered energy information about the Firehouse #2 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.

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 the results of BSG-PMK's survey, no capital improvement measures are recommended, as the building is well-maintained.

### Category II Recommendations: Operations and Maintenance

- 1) Based on the results of BSG-PMK's survey, no operations and maintenance measures are recommended, as the building is well-maintained.

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

At this time, SWA/BSG-PMK highly recommends a total of three (3) Energy Conservation Measures (ECMs) for Fire House #2 which are summarized in the following Table 1. The total investment cost for these ECMs, without incentives, is **\$3,180**, and with incentives, is **\$2,930**. SWA/BSG-PMK estimates a first year savings of **\$701** with a simple payback of **4.2 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Fire House #2 building by **5,502 lbs of CO<sub>2</sub>**.

SWA/BSG-PMK 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 \$ 0.01/kWh, which would have equated to \$255 for the past 12 months, and it may be possible to save up to \$0.14/therm, which would have equated to \$332 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 building in the previous year was 9.2 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, \$	CO <sub>2</sub> Reduced, lbs/yr
1	Programmable Thermostats	RS Means CostWorks 2009	\$640	\$0	\$640	0	0.0	180	7.81	\$0.00	\$304.20	10	\$2,569	2.10	301%	30%	46%	\$1,955	2,106
TOTAL			\$640	\$0	\$640	0	0.0	180	7.81	\$0.00	\$304	-	\$2,569	2.10	-	-	-	\$1,955	2,106

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, \$	CO <sub>2</sub> Reduced, lbs/yr
2	Lighting Upgrades	Empirical Data	\$830	\$180	\$650	906	0.2	0	1.34	\$0.00	\$145	15	\$1,707	4.48	163%	11%	20%	\$892	1,242
	Occupancy Sensors	Empirical Data	\$260	\$70	\$190	104	0.0	0	0.15	\$0.00	\$17	10	\$141	11.42	-26%	-3%	-2%	-\$48	142
3	Replace Window Air-Conditioners	Manufacturer Website	\$1,450	\$0	\$1,450	1,468	0.3	0	2.17	\$0.00	\$235	10	\$1,984	6.17	37%	4%	10%	\$554	2,012
TOTAL			\$2,540	\$250	\$2,290	2,479	0.5	0	3.67	\$0.00	\$397	-	\$3,831	5.77	-	-	-	\$1,398	3,396

ROI: Return on Investment (%)

**Assumptions:**

Discount rate:

Energy price escalation rate:

3.2% per DOE FEMP guidelines

0% per DOE FEMP guidelines

Electricity rate:

Gas rate:

\$0.16 \$/kWh

\$1.69 \$/therm

Area of Building (SF)

2,304

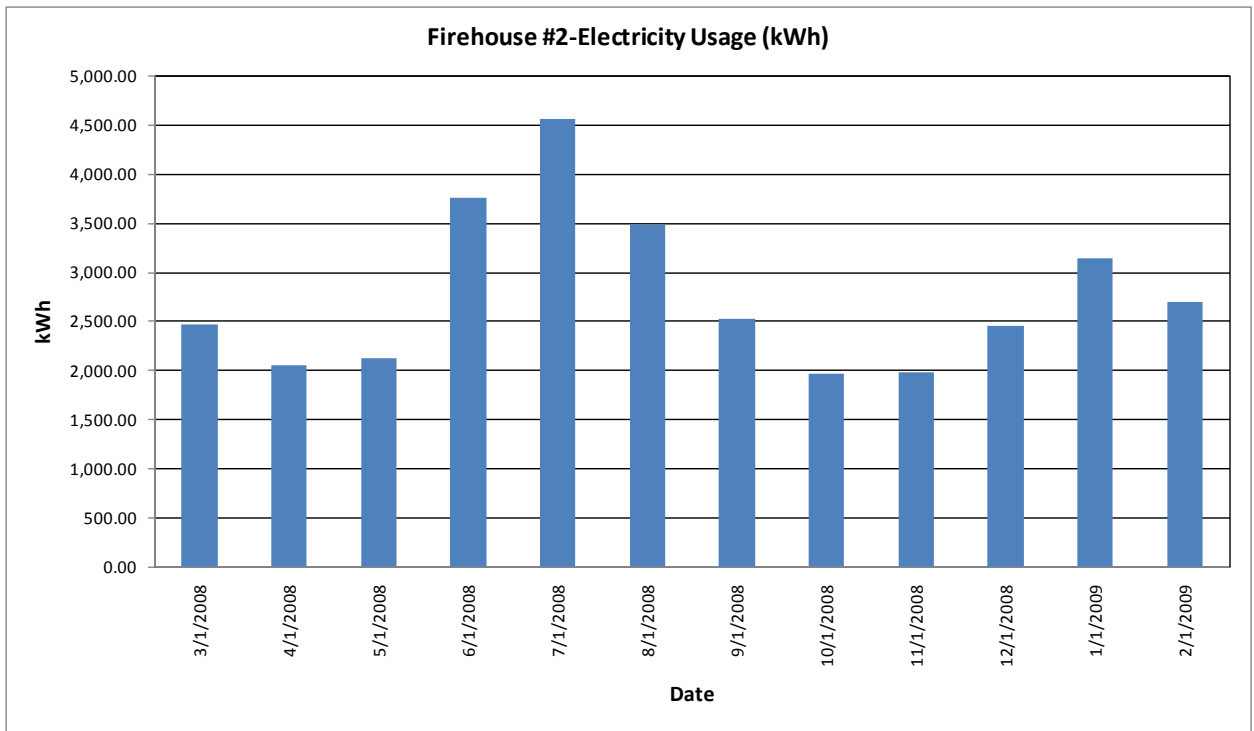
# 1. HISTORIC ENERGY CONSUMPTION

## 1.1. Energy usage and cost analysis

BSG-PMK analyzed utility bills from March, 2008 through February, 2009 that were received from the utility companies supplying the Firehouse #2 with electric and natural gas.

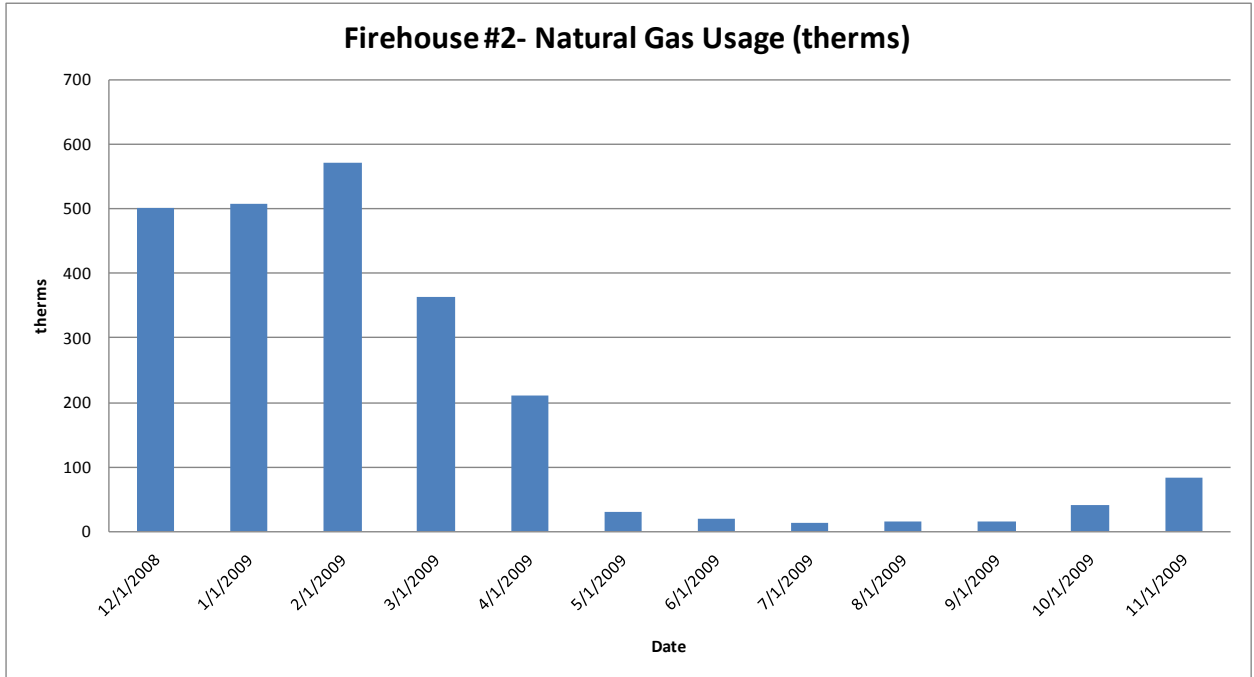
Electricity - The Firehouse #2 is currently served by one electric meter and purchases electricity from Public Service Electric & Gas at **an average rate of \$0.16/kWh** based on 12 months of utility bills from March, 2008 through February, 2009. The building purchased **33,252 kWh or \$5,243 worth 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 Firehouse #2 is currently served by one natural gas meter and buys gas from Elizabethtown Gas at **an average rate of \$1.69/therm** based on 12 months of utility bills from December, 2008 through November, 2009. The building purchased **2,375 therms or \$4,013 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 Firehouse #2 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 \$0.16/kWh based on the 12 months of utility bills of March, 2008 through February, 2009.

The Firehouse #2 currently purchases natural gas supply and transmission from Elizabethtown Gas at an average aggregated rate of \$1.69/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](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). SWA/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 152.3 kBtu/ft<sup>2</sup>yr. Implementing this report's recommendations will reduce use by approximately 11.5 kBtu/ft<sup>2</sup>yr, which when implemented would lower the buildings energy consumption.



## STATEMENT OF ENERGY PERFORMANCE Firehouse # 2

Building ID: 2036189  
For 12-month Period Ending: October 31, 2009<sup>1</sup>  
Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

**Facility**  
Firehouse # 2  
Pekola Terrace  
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:** 1950  
**Gross Floor Area (ft<sup>2</sup>):** 2,304

**Energy Performance Rating<sup>2</sup> (1-100)** N/A

### Site Energy Use Summary<sup>3</sup>

Electricity - Grid Purchase(kBtu)	113,456
Natural Gas (kBtu) <sup>4</sup>	249,584
Total Energy (kBtu)	363,040

### Energy Intensity<sup>5</sup>

Site (kBtu/ft <sup>2</sup> /yr)	158
Source (kBtu/ft <sup>2</sup> /yr)	278

### Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	31
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### Electric Distribution Utility

Public Service Elec & Gas Co

### National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	77%
Building Type	Fire Station/Police Station

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 Standards<sup>6</sup> 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 8 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**

Firehouse #2 was built in 1976. The one-story building has a total area of 2,304 square feet. Firehouse #2 has one engine bay and a fireman's lounge.

### **2.2. Building occupancy profiles**

The building is occupied from 8:00am-4:00pm by one or two firemen.

### **2.3. Building envelope**

#### **2.3.1.Exterior walls**

The exterior walls are constructed with a block and mortar façade on a masonry substrate. The interior walls are insulated and finished with gypsum wallboard

#### **2.3.2.Roof**

The built up, flat roof is constructed on wood decking. The roof is finished with asphalt. It was found to be in fair condition.

#### **2.3.3.Base**

The base of the building is poured concrete slab on grade. The base was found to be in fair condition.

#### **2.3.4.Windows**

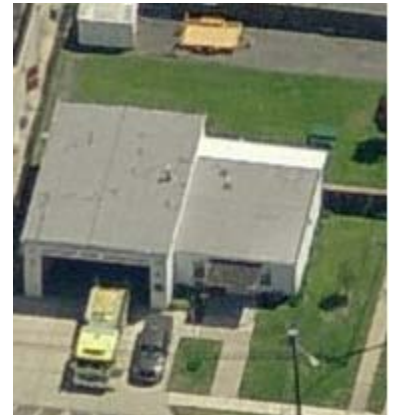
There are two double-pane aluminum framed windows on the building. All are in good condition.

#### **2.3.5.Exterior doors**

There are four aluminum doors, two aluminum doors with glass panes. All are in good condition with weather stripping.

#### **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**

Fire House #2's heating is generated by an 80%-efficient gas-fired hot water boiler, with a capacity no bigger than 250 MBH. The nameplate was facing the wall and could not be viewed. The unit was installed in 2007. There are also two Modine unit heaters in the garage, with inaccessible nameplates.

Category III Recommendations – ECM #1: Replace the two non-setback thermostats that control the heat with two programmable thermostats.

### **2.4.2. Cooling**

There is no central cooling system in the facility. The lounge is cooled by a window air-conditioner, which is about 10,000 BTUs. No nameplate was found on the unit. The entrance is cooled by a GE window air-conditioner, which is about 12,000 BTUs. Both units have passed their useful lives.

Category III Recommendations – ECM #3: Replace the two window air-conditioners with high-efficiency window units.

### **2.4.3. Ventilation**

Ventilation is provided by exhaust fans on the roof, doors, and windows.

### **2.4.4. Domestic Hot Water**

Water is heated by a 30 gallon, 30 MBH gas-fired water heater, which is about 3 years old. The heater is a Rheem Vanguard unit with model # 3WA57.

## **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 \$157.7 based on the current \$0.16/kWh and the current occupancy schedule. Implementation of this ECM will cost approximately \$1,090.00. Currently the Board of Public Utilities (BPU) would offer an estimated rebate of \$250, yielding a net cost of \$840 for this project. The payback on this ECM would about 5.3 years.

Category III Recommendation - ECM #2: 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 Fire House #2.

### 3. EQUIPMENT LIST

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Cooling	Through-the-wall air-conditioner; about 10,000 BTU	Lounge	Nameplate not accessible	Electricity	Lounge	approx. 1995	0%
Cooling	Through-the-wall air-conditioner; about 12,000 BTU	Entrance	GE (nameplate not accessible)	Electricity	Entrance	approx. 2000	0%
Heating	Very small hot-water boiler; no more than 250 MBH, 80% efficient	Mechanical closet	Unknown (nameplate not accessible)	Natural Gas	Entire Building	approx. 2008	95%
Domestic Hot Water	Domestic water heater; 30 gallons, 30 MBH	Mechanical closet	Rheem Vanguard M# 3WA57	Natural Gas	Entire Building	approx. 2007	90%
Heating	2 unit heaters; nameplates not accessible	Garage	Modine (nameplate not accessible)	Natural Gas	Garage	approx. 2000	40%

**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 the results of BSG-PMK’s survey, no capital improvement measures are recommended, as the building is well-maintained.

##### **Category II Recommendations: Operations and Maintenance**

- 1) Based on the results of BSG-PMK’s survey, no operations and maintenance measures are recommended, as the building is well-maintained.

##### **Category III Recommendations: Energy Conservation Measures**

###### **Summary table**

<b>ECM #</b>	<b>ECM Description</b>
<b>1</b>	<b>Programmable Thermostats</b>
<b>2</b>	<b>Lighting Upgrades and Occupancy Sensors</b>
<b>3</b>	<b>Replace Window Air-Conditioners</b>

## ECM#1: Programmable Thermostats

### Description:

Heating at Fire House #2 is controlled by two non-setback thermostats. Non-setback thermostats need to be adjusted manually, so the heating would not be lowered automatically when the building is not in use. Setback thermostats do adjust the temperature automatically when the facility is not in use, and save energy by not causing excess heating and cooling to be used when the building is unoccupied. This building, however, is occupied by at least one person at all times, so it will not be necessary to keep both thermostats at a much lower temperature at night, but due to the low cost of installation, it will still produce enough savings to yield a very good payback.

### Installation cost:

Estimated installed cost: \$320 each, \$640 total  
 Source of cost estimate: 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, \$	CO2 Reduced, lbs/yr
1	Programmable Thermostats	RS Means CostWorks 2009	\$640	\$0	\$640	0	0.0	180	7.81	\$0.00	\$304.20	10	\$2,569	2.10	301%	30%	46%	\$1,955	2,106

### Assumptions:

Using utility data for the calendar year beginning in December, 2008 and ending in November, 2009, it was determined that the average cost of natural gas for the year was \$1.69/therm; during this time, the heating system consumed 2,375 therms. For the heating season, the occupied and unoccupied temperatures were assumed to be 68°F and 63°F, respectively. Since at least part of the building will still be occupied, it is not necessary to set the temperature back very far. The average hours of setback for the three buildings were estimated to be 12 hours every night. The savings were calculated using Honeywell's Commercial Programmable Thermostat Energy Savings Calculator, an Excel spreadsheet, which assumes 3% savings per degree of setback for the heating season, and 6% for the cooling season.

### Rebates/financial incentives:

No rebates or incentives for programmable thermostats could be found.

## ECM#2: Lighting Upgrades and Occupancy Sensors

### Description:

Lighting at the Carteret Fire House #2 consists half and half of standard efficiency T-12 fluorescent lamps with magnetic ballasts and energy efficient T-8 lamps with electronic ballasts. It is recommended that all remaining T-12 fixtures with magnetic ballasts be retrofit with T-8 lamps and electronic ballasts. There are also 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:

	<b>Lighting (Only)</b>	<b>Sensors (Only)</b>	<b>Complete Lighting Upgrade</b>
<b>Cost</b>	\$830.00	\$260.00	\$1,090.00
<b>Rebate</b>	\$180.00	\$70.00	\$250.00
<b>Net Cost</b>	\$650.00	\$190.00	<b>\$840.00</b>
<b>Savings (kWh)</b>	906	104	<b>986</b>
<b>Savings (\$)</b>	\$145.04	\$16.64	<b>\$157.73</b>
<b>Payback</b>	4.5	11.4	<b>5.3</b>

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	Therm, 1st Yr Savings	kBtu/yr, 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	Lighting Upgrades	Empirical Data	\$830	\$180	\$650	906	0.2	0	1.34	\$0.00	\$145	15	\$1,707	4.48	163%	11%	20%	\$892	1,242
	Occupancy Sensors	Empirical Data	\$260	\$70	\$190	104	0.0	0	0.15	\$0.00	\$17	10	\$141	11.42	-26%	-3%	-2%	-\$48	142

**Assumptions:**

The electric cost used in this ECM was \$0.16/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 \$250.

### ECM#3: Replace Window Air-Conditioners

#### Description:

The only two units that provide cooling to Fire House #2 are window air-conditioners. One unit was rated at 10,000 BTUs; the other did not have a visible nameplate, but was slightly larger, so it can be estimated to be about 12,000 BTUs. It is recommended that, due to the fact that both units are old and in poor condition, that they be replaced. Newer room air-conditioner models have higher Energy Efficiency Ratios (EERs), and many of which meet EnergyStar specifications.

#### Installation cost:

Estimated installed cost:

10,000 BTU unit: \$639 (equipment only)

12,000 BTU unit: \$659 (equipment only)

Total: Equipment, labor, and sales tax would bring the total cost to about \$1,450

Source of cost estimate: General Electric, official website (ge.com)

#### Economics:

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Thermos, 1st Yr Savings	kBtu/eq 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 <sub>2</sub> Reduced, lbs/yr
3	Replace Window Air-Conditioners	Manufacturer Website	\$1,450	\$0	\$1,450	1,468	0.3	0	2.17	\$0.00	\$235	10	\$1,984	6.17	37%	4%	10%	\$554	2,012

#### Assumptions:

Using the facility's electricity bills from March, 2008 through February, 2009, it was determined that the cost of electricity is currently \$0.16/kWh. EER (Energy Efficiency Ratio, or the ratio of cooling output to electric input) values for the new units are 9.5. Original EER values for the current units were estimated to be lower, at 8.5, and their age and condition indicates a decrease of their EERs of 25%, to 6.4. 1,024 cooling degree-days and a 0.4% dry-bulb temperature of 93°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 74°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:

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

Using this information, it was calculated that the new room air-conditioners would reduce Fire House #2's annual electric consumption by 1,468 kWh, totaling an annual savings of \$232 and yielding a 6.3-year payback. The decrease in energy consumption is due to less electricity being required to produce the required BTUs of cooling.

**Rebates/financial incentives:**

No rebates for room air-conditioners are available.

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](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 for this location because there is not enough roof space with unobstructed southern exposure and the roof did not appear to be able to support the weight of a 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.

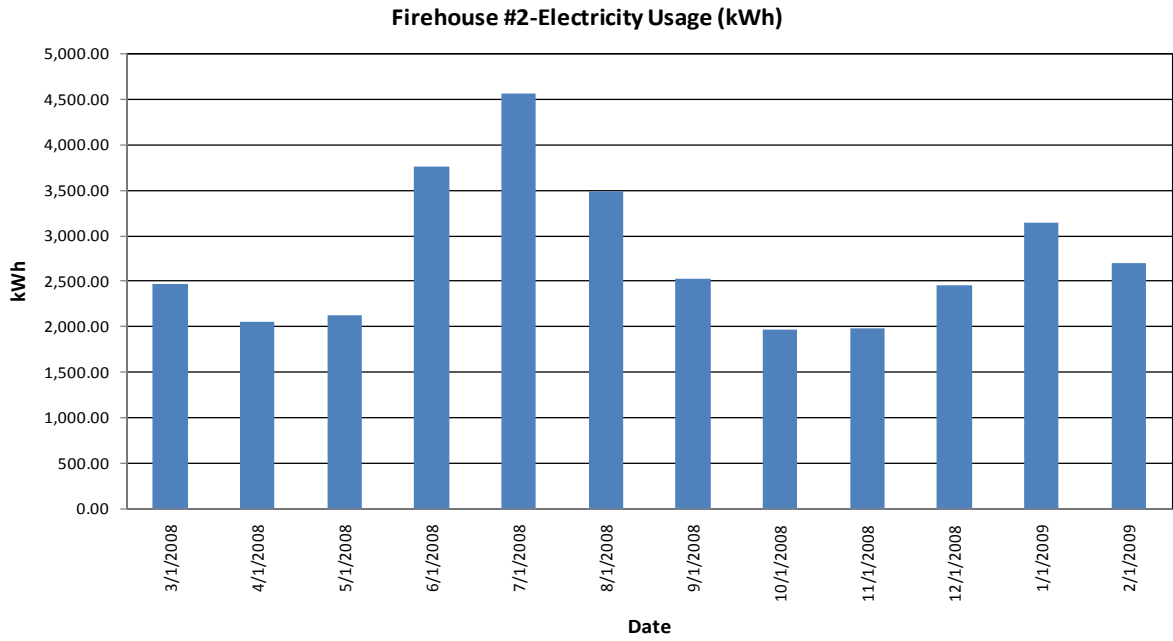
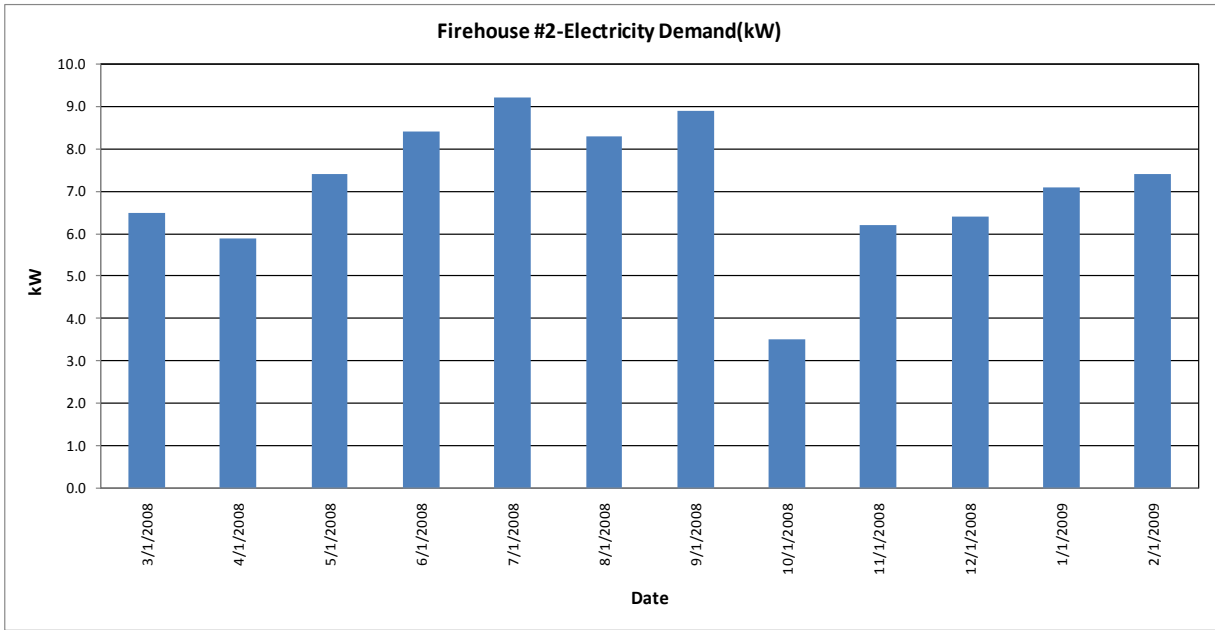
### **5.6. Wind**

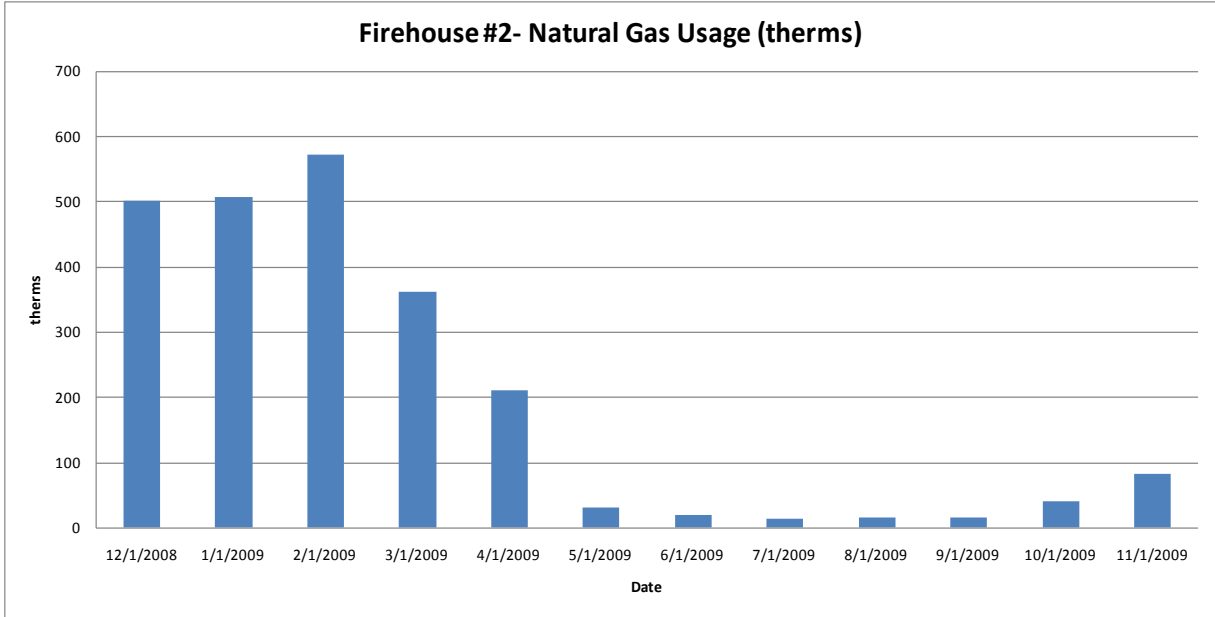
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

## **6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES**

### **6.1. Load profiles**

The average electrical peak demand for the facility during previous year was 7.1 kW and the maximum peak demand was 9.2 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.

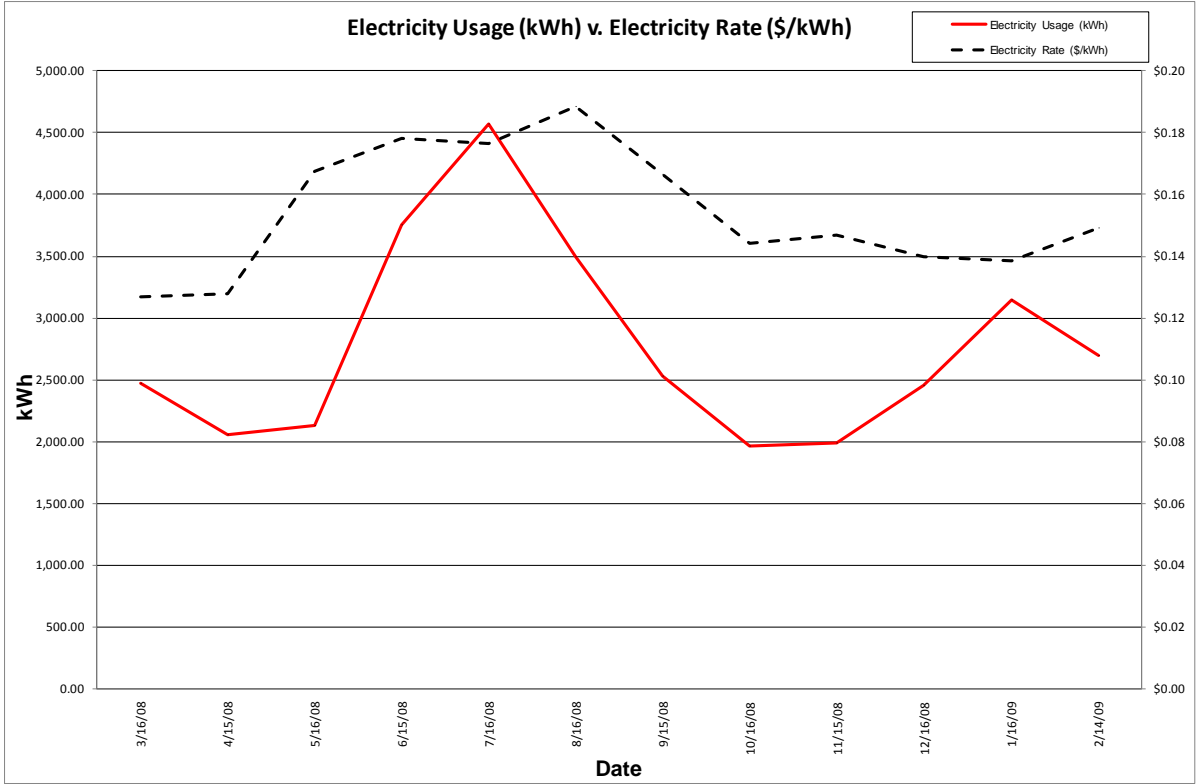




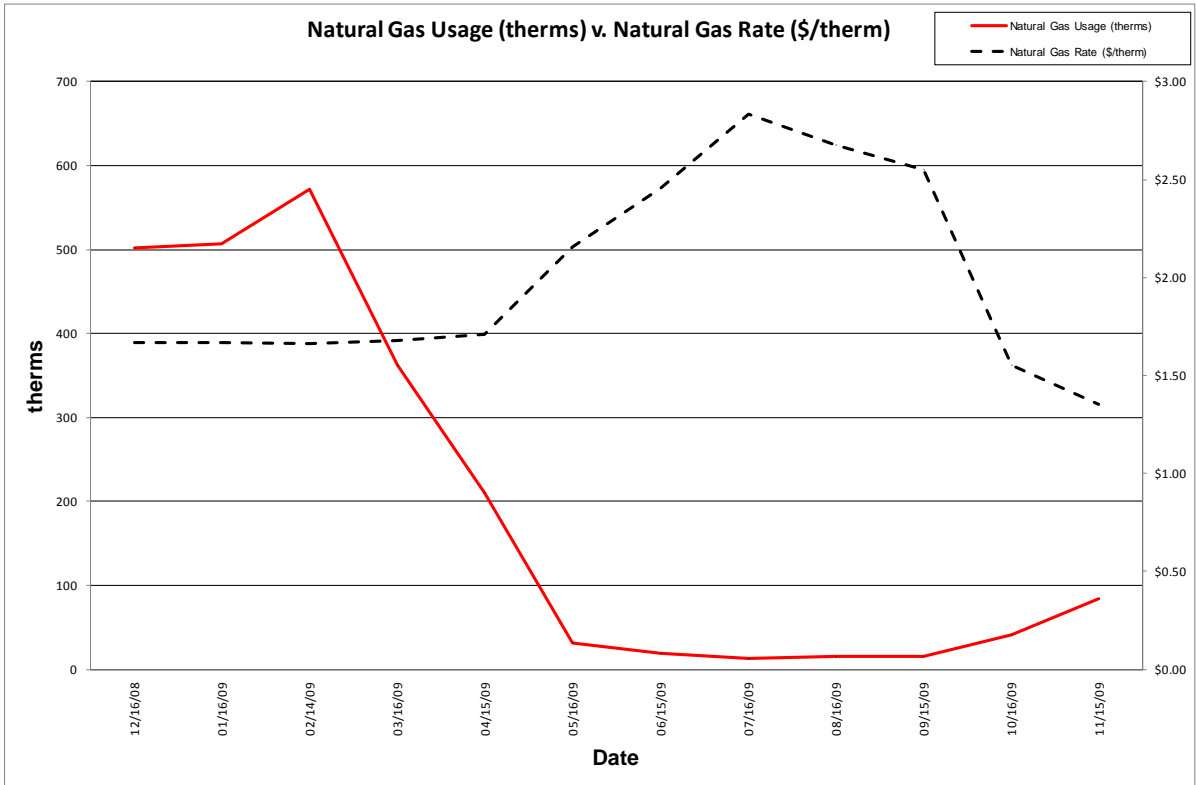
**6.2. Energy Procurement strategies**

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

SWA/BSG-PMK 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 \$ 0.01/kWh, which would have equated to \$255 for the past 12 months, and it may be possible to save up to \$0.14/therm, which would have equated to \$332 for the past 12 months.



*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***

Appendix A: Lighting Study

**LIGHTING ANALYSIS**

Borough of Carteret  
Firehouse #2  
Pekola Terr. & Germak Ave.



Upgrade Code	Upgrade Description	Existing		Proposed		Lighting		
		Fixture	Watts	Fixture	Watts	Total # of Upgrades	Cost per Upgrade (\$)	SmartStart Rebate per Upgrade
1	(2) 34W T12 Lamps, Magnetic Ballasts / Retrofit with T8 Lamps, Electronic Ballast	2L4' EE/STD	80	2L4' T8/ELEC	61	10	\$70.00	\$15.00
2	(2) 4' 32W T8 Lamps, Electronic Ballast / No Upgrade	2L4' T8/ELEC	61	No Upgrade	61	10	\$0.00	\$0.00
3	60W Incandescent / Replace with 26W Compact Fluorescent	60W INCANDESCENT	60	26W CF	28	1	\$10.00	\$0.00
4	70W Metal Halide Wall Packs / No Upgrade	70W MH/BALLAST	95	No Upgrade	95	6	\$0.00	\$0.00
5	Incandescent Exit Signs / Retrofit with LED	15W EXIT	15	LED	2	3	\$40.00	\$10.00
6						0	\$0.00	\$0.00
7						0	\$0.00	\$0.00
8						0	\$0.00	\$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
<b>Cost</b>	\$830.00	\$260.00	\$1,090.00
<b>Rebate</b>	\$180.00	\$70.00	\$250.00
<b>Net Cost</b>	\$650.00	\$190.00	<b>\$840.00</b>
<b>Savings (kWh)</b>	906	104	<b>986</b>
<b>Savings (\$)</b>	\$145.04	\$16.64	<b>\$157.73</b>
<b>Payback</b>	4.5	11.4	<b>5.3</b>

**Variables:**

\$0.16	Avg. Electric Rate (\$/kWh)
	Avg. Demand Rate (\$/kW)
2600	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			kW Reduction	Lighting				Occupancy Sensors (ONLY)				SmartStart Rebate		Lighting & Occupancy Sensors						
					Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.		Watts	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	Controls Type	Qty.	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	Lighting	Sensors	Energy Savings, kWh	Post-Rebate Cost (\$)	Savings (\$)	Payback (yrs)
<b>Totals:</b>					2085				1824	0.261	906	\$830.00	\$145.04	5.7			104	\$260.00	\$16.64	15.6	\$180.00	\$70.00	986	\$840.00	\$157.73	5.3		
1	1	exterior lights	7	2275	2L4' EE/STD	2	160		2L4' T8/ELEC	2	122	0.038	86	\$140.00	\$13.83	10.1		0	\$0.00	\$0.00		\$30.00	\$0.00	86	\$110.00	\$13.83	8.0	
2	1	Lounge	8	2600	2L4' EE/STD	4	320		2L4' T8/ELEC	4	244	0.076	198	\$280.00	\$31.62	8.9		0	\$0.00	\$0.00		\$60.00	\$0.00	198	\$220.00	\$31.62	7.0	
3	1	Kitchen	8	2600	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	49	\$70.00	\$7.90	8.9		0	\$0.00	\$0.00		\$15.00	\$0.00	49	\$55.00	\$7.90	7.0	
4	1	Restroom	8	2600	2L4' EE/STD	2	160		2L4' T8/ELEC	2	122	0.038	99	\$140.00	\$15.81	8.9	OSR	1	104	\$260.00	\$16.64	15.6	\$30.00	\$70.00	178	\$300.00	\$28.50	10.5
5	2	Engine Room	8	2600	2L4' T8/ELEC	10	610		No Upgrade	10	610	0	0	\$0.00	\$0.00			0	\$0.00	\$0.00		\$0.00	\$0.00	0	\$0.00	\$0.00		
6	3	Foyer Closet	8	2600	60W INCANDESCENT	1	60		26W CF	1	28	0.032	83	\$10.00	\$13.31	0.8		0	\$0.00	\$0.00		\$0.00	\$0.00	83	\$10.00	\$13.31	0.8	
7	1	Women's Room	8	2600	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	49	\$70.00	\$7.90	8.9		0	\$0.00	\$0.00		\$15.00	\$0.00	49	\$55.00	\$7.90	7.0	
8	4	Exterior Lights	7	2275	70W MH/BALLAST	6	570		No Upgrade	6	570	0	0	\$0.00	\$0.00			0	\$0.00	\$0.00		\$0.00	\$0.00	0	\$0.00	\$0.00		
9	5	Exit Signs	24	8760	15W EXIT	3	45		LED	3	6	0.039	342	\$120.00	\$54.66	2.2		0	\$0.00	\$0.00		\$30.00	\$0.00	342	\$90.00	\$54.66	1.6	

## 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
<b>Hess Corporation</b> 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 <a href="http://www.hess.com">www.hess.com</a>	<b>Cooperative Industries</b> 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 <a href="http://www.cooperativenet.com">www.cooperativenet.com</a>
<b>American Powernet Management, LP</b> 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 <a href="http://www.americapowernet.com">www.americapowernet.com</a>	<b>Direct Energy Services, LLC</b> 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 <a href="http://www.directenergy.com">www.directenergy.com</a>
<b>BOC Energy Services, Inc.</b> 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 <a href="http://www.boc.com">www.boc.com</a>	<b>Gateway Energy Services Corp.</b> 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 <a href="http://www.gesc.com">www.gesc.com</a>
<b>Commerce Energy, Inc.</b> 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 <a href="http://www.commerceenergy.com">www.commerceenergy.com</a>	<b>UGI Energy Services, Inc.</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a>
<b>ConEdison Solutions</b> 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 <a href="http://www.conedsolutions.com">www.conedsolutions.com</a>	<b>Great Eastern Energy</b> 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 <a href="http://www.greateastern.com">www.greateastern.com</a>
<b>Constellation NewEnergy, Inc.</b> 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 <a href="http://www.newenergy.com">www.newenergy.com</a>	<b>Glacial Energy of New Jersey, Inc.</b> 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 <a href="http://www.glacialenergy.com">www.glacialenergy.com</a>
<b>Credit Suisse, (USA) Inc.</b> 700 College Road East Princeton, NJ 08450	(212) 538-3124 <a href="http://www.creditsuisse.com">www.creditsuisse.com</a>	<b>Hess Corporation</b> 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 <a href="http://www.hess.com">www.hess.com</a>
<b>Direct Energy Services, LLC</b> 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 <a href="http://www.directenergy.com">www.directenergy.com</a>	<b>Intelligent Energy</b> 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 <a href="http://www.intelligentenergy.org">www.intelligentenergy.org</a>
<b>FirstEnergy Solutions</b> 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 <a href="http://www.fes.com">www.fes.com</a>	<b>Metromedia Energy, Inc.</b> 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 <a href="http://www.metromediaenergy.com">www.metromediaenergy.com</a>
<b>Glacial Energy of New Jersey, Inc.</b> 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 <a href="http://www.glacialenergy.com">www.glacialenergy.com</a>	<b>MxEnergy, Inc.</b> 510 Thomall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 <a href="http://www.mxenergy.com">www.mxenergy.com</a>
<b>Metro Energy Group, LLC</b> 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 <a href="http://www.metroenergy.com">www.metroenergy.com</a>	<b>NATGASCO (Mitchell Supreme)</b> 532 Freeman Street Orange, NJ 07050	(800) 840-4427 <a href="http://www.natgasco.com">www.natgasco.com</a>
<b>Integrus Energy Services, Inc.</b> 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 <a href="http://www.integrusenergy.com">www.integrusenergy.com</a>	<b>Pepco Energy Services, Inc.</b> 112 Main Street Lebanon, NJ 08833	(800) 363-7499 <a href="http://www.pepco-services.com">www.pepco-services.com</a>
<b>Liberty Power Delaware, LLC</b> Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 <a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>	<b>PPL EnergyPlus, LLC</b> 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 <a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>
<b>Liberty Power Holdings, LLC</b> Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 <a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>	<b>South Jersey Energy Company</b> One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 <a href="http://www.southjerseyenergy.com">www.southjerseyenergy.com</a>
<b>Pepco Energy Services, Inc.</b> 112 Main St. Lebanon, NJ 08833	(800) 363-7499 <a href="http://www.pepco-services.com">www.pepco-services.com</a>	<b>Sprague Energy Corp.</b> 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 <a href="http://www.spragueenergy.com">www.spragueenergy.com</a>
<b>PPL EnergyPlus, LLC</b> 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 <a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>	<b>Strategic Energy, LLC</b> 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 <a href="http://www.sel.com">www.sel.com</a>
<b>Sempra Energy Solutions</b> 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 <a href="http://www.semprasolutions.com">www.semprasolutions.com</a>	<b>Suez Energy Resources NA, Inc.</b> 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 <a href="http://www.suezenergyresources.com">www.suezenergyresources.com</a>
<b>South Jersey Energy Company</b> One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 <a href="http://www.southjerseyenergy.com">www.southjerseyenergy.com</a>	<b>UGI Energy Services, Inc.</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a>
<b>Sprague Energy Corp.</b> 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 <a href="http://www.spragueenergy.com">www.spragueenergy.com</a>		
<b>Strategic Energy, LLC</b> 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 <a href="http://www.sel.com">www.sel.com</a>		
<b>Suez Energy Resources NA, Inc.</b> 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 <a href="http://www.suezenergyresources.com">www.suezenergyresources.com</a>		
<b>UGI Energy Services, Inc.</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a>		