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*April 30, 2010*

**Local Government Energy Program**
**Energy Audit Final Report**

# *South River George Street Firehouse*
***South River, NJ 08882***

***Project Number: LGEA48***

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## INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Borough of South River municipal buildings. The audit, conducted on January 5th, 11th and 12th, included a review of the:

- Human Services Building
- Municipal Building
- Public Library
- Criminal Justice Building
- War Memorial Building
- Roads Department Building
- Rescue Squad Building
- George Street Firehouse
- Appleby Avenue Firehouse

The buildings are located in South River, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the South River George Street Firehouse located on George St., South River, NJ 08882. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The two-story South River George Street Firehouse was originally built in 1926 with the latest addition / renovation occurring in 1982 when Engine Co. 1 one story building was added. The building consists of 7,412 square feet of conditioned space. The first floor houses Reliable Engine Co. - 2 truck bays, a lounge, a toilet, a radio room and Engine Co. 1 - 1 truck bay. The second floor houses the chief's office, a ladies auxiliary room, a storage closet, a toilet room, an Engine Co. 1 office and a second floor meeting room. Occupancy at the George Street Firehouse is sporadic, usually 2 - 5 volunteers for approximately 4 hours per day. There is usually one special event / training held in the meeting room or lounge every couple of months for volunteer firemen members.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of South River to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the George Street Firehouse.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

## EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the George Street Firehouse located on George St., South River, NJ 08882. The George Street Firehouse is a two-story building comprising of a total floor area of 7,412 square feet. The original structure was built in 1926 with the latest addition / renovation occurring in 1982.

Based on the field visits performed by the SWA staff on January 5th, 11th and 12th 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.

From November 2008 through October 2009 the George Street Firehouse consumed 88,880 kWh or $11,554 worth of electricity at an approximate rate of $0.130/kWh and 2,267 therms or $2,847 worth of natural gas at an approximate rate of $1.256/therm. The joint energy consumption for the building, including both electricity and natural gas, was 530 MMBtu of energy that cost a total of $14,401.

SWA has entered energy information about the George Street Firehouse in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Fire Station facility is comprised of non-eligible (Other) space type, since national comparisons are yet unavailable for rating. SWA encourages the Borough of South River to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 72.0 kBtu/ft$^2$yr compared to the national average of Borough Fire Station building consuming 78.0 kBtu/ft$^2$yr. Implementing this report's recommendations will reduce use by approximately 4.9 kBtu/ft$^2$yr, which when implemented would make the building energy consumption even better than the national average.

Based on the assessment of the George Street Firehouse, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

### Category I Recommendations: Capital Improvement Measures

- Replace common area heating equipment
- Replace window air conditioners
- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- Replace all original / single glazed windows with double glazed, low-E type

### Category II Recommendations: Operations and Maintenance

- Maintain / repair garage doors
- Thoroughly and evenly insulate space above the second floor ceiling
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts and cap flashing - repair / install missing downspouts and cap flashing as needed
- Provide weather stripping / air sealing

- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **2** Energy Conservation Measures (ECMs) for the George Street Firehouse that is summarized in the following Table 1. The total investment cost for these ECMs without incentives is **$1,358**. SWA estimates a first year savings of **$808** with a simple payback of **1.7 years**. SWA also recommends **1** more ECM with a total first year savings of **$1,146** that is summarized in Table 2 and **2** recommended End of Life Cycle ECM with a total first year savings of **$886** that is summarized in Table 3. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the George Street Firehouse by **19,173 lbs of $CO_2$**, which is equivalent to removing approximately 2 cars from the roads each year or avoiding the need of 47 trees to absorb the annual $CO_2$ generated.

There are various incentives available in New Jersey to lower the cost of installing the Energy Conservation Measures (ECMs), like NJ SmartStart program and Direct Install through the New Jersey Office of Clean Energy. These incentive programs can help provide technical assistance for the building in the implementation phase of any energy conservation project. The Borough of South River and 6 other nearby boroughs have a long term contract to purchase electricity as a consortium from the South River Electric Utility and do not pay the Societal Benefit Charges (SBCs) that fund NJCEP programs. Therefore, the Borough of South River is not eligible to receive any equipment incentives for energy conservation under the New Jersey Clean Energy Program (NJCEP) at the present time. SWA recommends the Borough of South River initiate a dialogue with the Board of Public Utilities (BPU) to gain access to these and other incentives in the future.

The following three tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight / potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating / cooling).

| Table 1 - Highly Recommended 0-5 Year Payback ECMs | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
| 1 | install (2) Drinks vending machine energy misers - in radio and back rooms | www.usatech.com and established costs | 558 | 0 | 558 | 2,912 | 0.6 | 0 | 1.3 | 0 | 379 | 12 | 4,543 | 1.5 | 714 | 60 | 68 | 3,067 | 5,214 |
| 2.1 | replace (4) incandescent and (12) Metal Halide bulbs with CFLs | RS Means, Lit Search | 800 | 0 | 800 | 2,902 | 0.6 | 0 | 1.3 | 53 | 430 | 5 | 2,149 | 1.9 | 169 | 34 | 45 | 1,121 | 5,196 |
| | **Totals** | | **1,358** | **0** | **1,358** | **5,814** | **1.3** | **0** | **2.7** | **53** | **808** | **-** | **6,692** | **1.7** | **393** | **-** | **56** | **4,189** | **10,410** |

**Assumptions:** Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
**Note:** A 0.0 electrical demand reduction / month indicates that it is very low / negligible

| Table 2 - Recommended 5-10 Year Payback ECMs | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
| 3 | replace one (1) Ladies Aux room refrigerator with an 18 cu ft Energy Star model | Energy Star purchasing and procurement site, similar projects | 750 | 0 | 750 | 350 | 0.1 | 0 | 0.2 | 50 | 96 | 12 | 1,146 | 7.9 | 53 | 4 | 7 | 183 | 627 |
| | **Totals** | | **750** | **0** | **750** | **350** | **0.1** | **0** | **0.2** | **50** | **96** | **-** | **1,146** | **7.9** | **53** | **-** | **7** | **183** | **627** |

| Table 3 - Recommended End of Life Cycle ECMs | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
| 2.2 | replace (53) T12 fixtures throughout the bldg with new T8 fixtures | RS Means, Lit Search | 11,395 | 0 | 11,395 | 3,744 | 0.8 | 0 | 1.7 | 245 | 732 | 15 | 10,976 | 15.6 | -4 | 0 | 0 | -2,698 | 6,704 |
| 4 | replace one (1) old bar icemaker with an Energy Star model | Energy Star purchasing and procurement site, similar projects | 2,800 | 0 | 2,800 | 800 | 0.2 | 0 | 0.4 | 50 | 154 | 12 | 1,848 | 18.2 | -34 | -3 | -6 | -1,245 | 1,432 |
| | **Totals** | | **14,195** | **0** | **14,195** | **4,544** | **1.0** | **0** | **2.1** | **295** | **886** | **-** | **12,824** | **16.0** | **-10** | **-** | **-1** | **-3,944** | **8,136** |

## 1. HISTORIC ENERGY CONSUMPTION

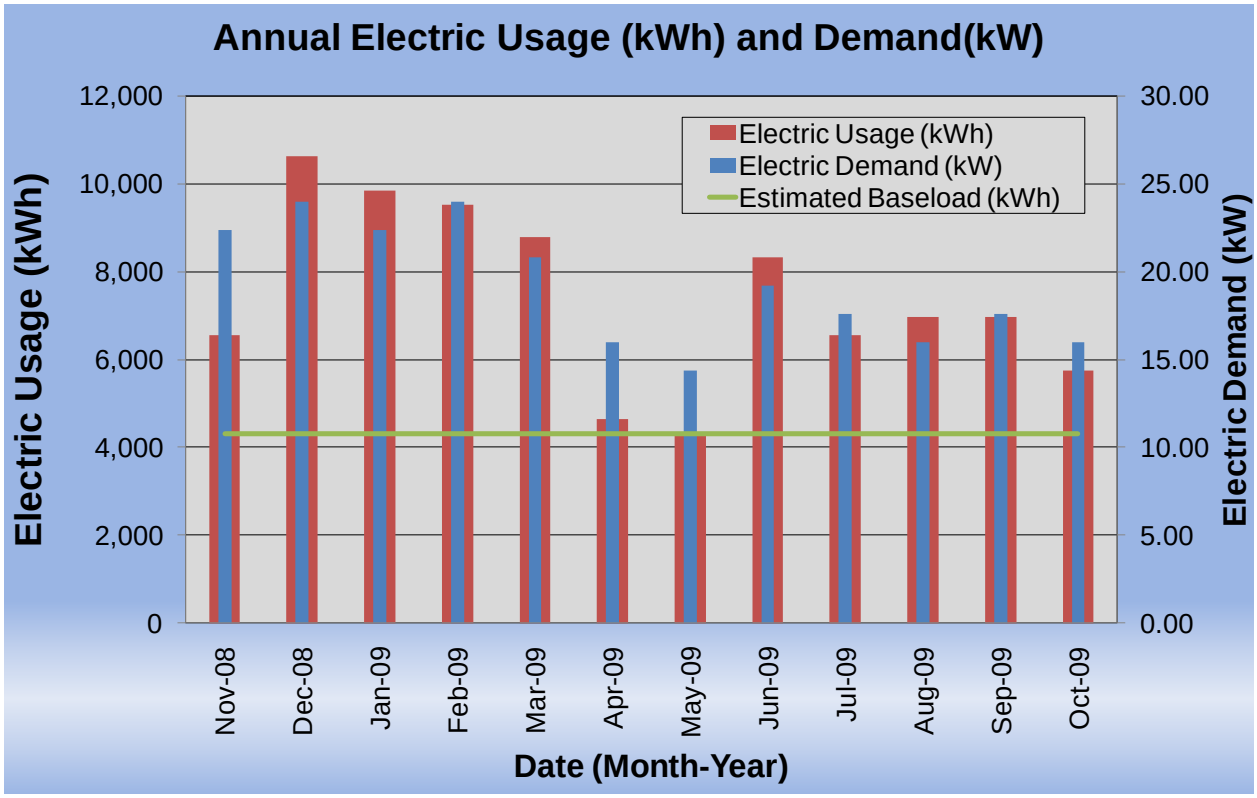
### 1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from December 2007 through October 2009 that were received from the utility companies supplying the South River George Street Firehouse with electric and natural gas.

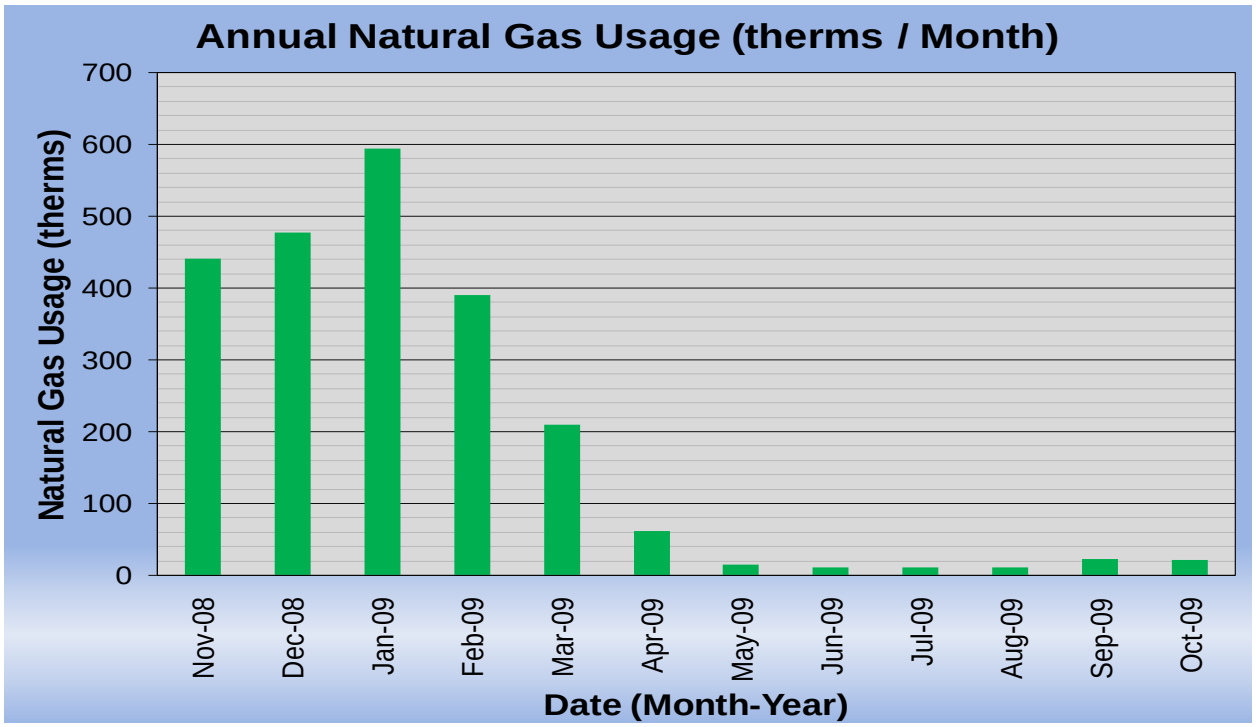
Electricity - The South River George Street Firehouse is currently served by one electric meter. The George Street Firehouse currently buys electricity from South River Electric Utility at **an average rate of $0.130/kWh** based on 12 months of utility estimates from November 2008 through October 2009. The George Street Firehouse purchased **approximately 88,880 kWh or $11,554 worth of electricity** in the previous year. The average monthly demand was 19 kW.

Natural gas - The South River George Street Firehouse is currently served by one meter for natural gas. The South River George Street Firehouse currently buys natural gas from PSE&G at **an average aggregated rate of $1.256/therm** based on 12 months of utility bills for November 2008 through October 2009. The South River George Street Firehouse purchased **approximately 2,267 therms or $2,847 worth of natural gas** in the previous year at a very competitive rate.

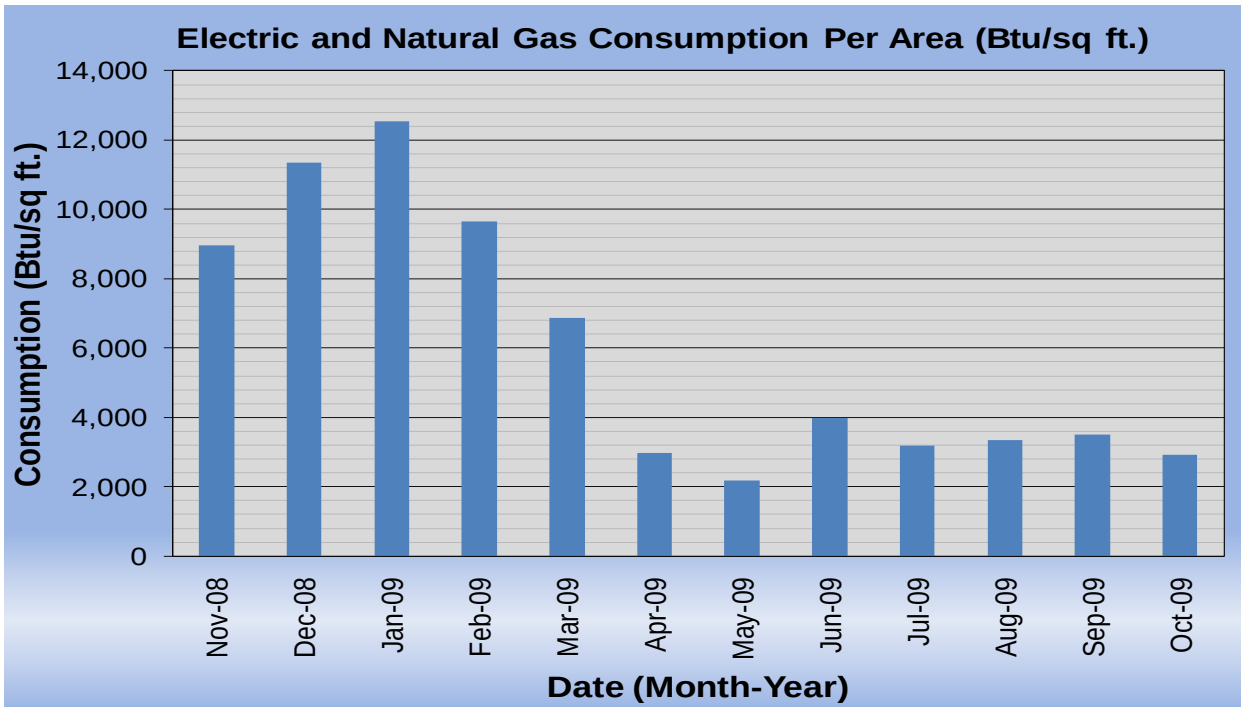
The following chart shows electricity consumption for the George Street Firehouse based on electric bills for the 12 month period of November 2008 through October 2009.



The following chart shows the natural gas consumption for the George Street Firehouse based on natural gas bills for the 12 month period of November 2008 through October 2009. Summer natural gas usage most likely associated with exercising / operating the natural gas generator.

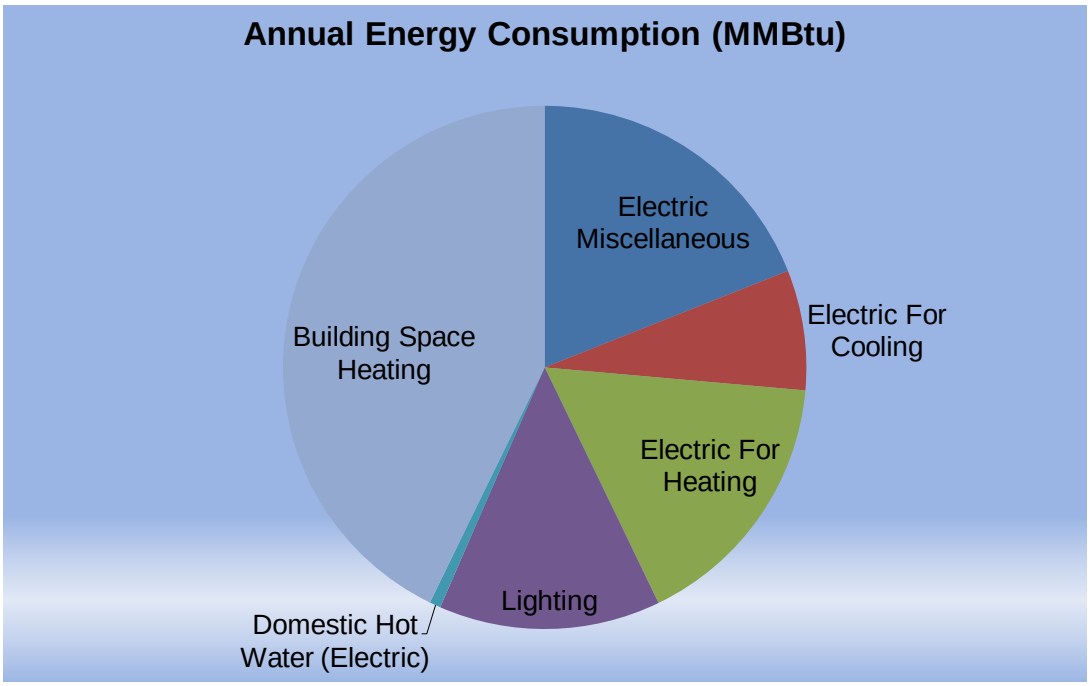


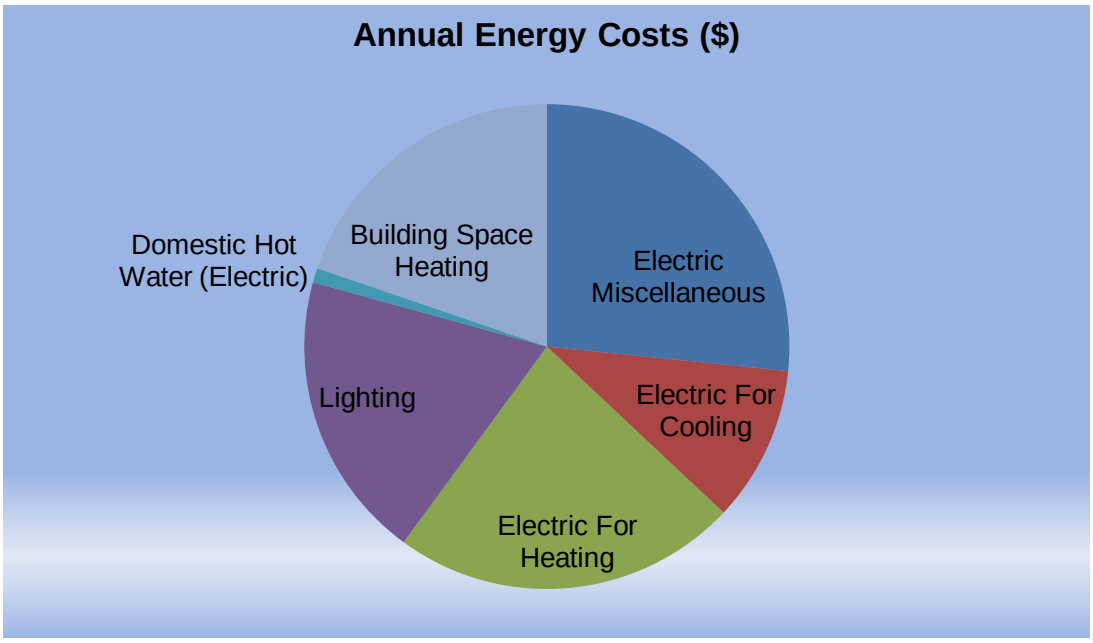

The following chart shows combined natural gas and electric consumption in Btu/sq ft for the George Street Firehouse based on estimates and utility bills for the 12 month period of November 2008 through October 2009.



The following table and chart pies show energy use for the George Street Firehouse based on utility bills for the 12 month period of November 2008 through October 2009. Note electrical cost at $38/MMBtu of energy is 3 times as expensive to use as natural gas at $13/MMBtu.

| 2009 Annual Energy Consumption / Costs | | | | | |
|---|---|---|---|---|---|
| | **MMBtu** | **% MMBtu** | **$** | **% $** | **$/MMBtu** |
| **Electric Miscellaneous** | 101 | 19% | $3,833 | 27% | 38 |
| **Electric For Cooling** | 39 | 7% | $1,498 | 10% | 38 |
| **Electric For Heating** | 87 | 16% | $3,318 | 23% | 38 |
| **Lighting** | 73 | 14% | $2,767 | 19% | 38 |
| **Domestic Hot Water (Electric)** | 4 | 1% | $139 | 1% | 38 |
| | | | | | |
| **Building Space Heating** | 227 | 43% | $2,847 | 20% | 13 |
| **Totals** | 530 | 100% | $14,401 | 100% | 27 |
| | | | | | |
| **Total Electric Usage** | 303 | 57% | $11,554 | 80% | 38 |
| **Total Gas Usage** | 227 | 43% | $2,847 | 20% | 13 |
| **Totals** | 530 | 100% | $14,401 | 100% | 27 |






### 1.2. Utility Rate

The George Street Firehouse currently purchases electricity from South River Electric Utility at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The George Street Firehouse currently pays an average rate of approximately $0.130/kWh based on the 12 months estimates of November 2008 through October 2009.

The George Street Firehouse currently purchases natural gas from PSE&G at a competitive general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the George Street Firehouse currently. The average aggregated rate (supply and transport) for the meter is approximately $1.256/therm based on 12 months of utility bills for November 2008 through October 2009.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

### 1.3. Energy Benchmarking

SWA has entered energy information about the George Street Firehouse in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Fire Station facility is comprised of non-eligible (Other) space type, since national comparisons are yet unavailable for rating. A Fire Station facility space or "Other" can be used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the George Street Firehouse is not eligible to receive a national energy performance rating at this time.

The Site Energy Use Intensity is 72.0 kBtu/sq ft yr compared to the national average of a Borough Fire Station building consuming 78.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 2.7 kBtu/sq ft yr, with an additional 0.2 kBtu/sq ft yr from the recommended ECMs and 2.1 kBtu/sq ft

yr from the recommended End of Life Cycle ECMs. These recommendations could account for at least 4.9 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption even better than the national average.

Per the LGEA program requirements, SWA has assisted the Borough of South River to create an *Energy Star Portfolio Manager* account and share the George Street Firehouse facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Borough of South River (user name of "sriverboro" with a password of "sriverboro") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

# STATEMENT OF ENERGY PERFORMANCE
# Borough of South River - George St. Firehouse

**Building ID:** 2019293
**For 12-month Period Ending:** October 31, 2009[1]
**Date SEP becomes ineligible:** N/A

**Date SEP Generated:** February 08, 2010

**Facility**
Borough of South River - George St. Firehouse
George Street
South River, NJ 08882

**Facility Owner**
N/A

**Primary Contact for this Facility**
N/A

**Year Built:** 1926
**Gross Floor Area (ft²):** 7,412

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

**Site Energy Use Summary**[3]

| | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 300,897 |
| Natural Gas (kBtu)[4] | 233,587 |
| Total Energy (kBtu) | 534,484 |

**Energy Intensity**[5]

| | |
|---|---|
| Site (kBtu/ft²/yr) | 72 |
| Source (kBtu/ft²/yr) | 169 |

**Emissions** (based on site energy use)

| | |
|---|---|
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 58 |

**Electric Distribution Utility**
Borough of South River

**National Average Comparison**

| | |
|---|---|
| National Average Site EUI | 78 |
| National Average Source EUI | 157 |
| % Difference from National Average Source EUI | 7% |
| 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.

**Certifying Professional**
N/A

**Meets Industry Standards**[6] **for Indoor Environmental Conditions:**

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

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



EPA Form 5900-16

## 2. FACILITY AND SYSTEMS DESCRIPTION

### 2.1. Building Characteristics

The two-story South River George Street Firehouse was originally built in 1926 with the latest addition / renovation occurring in 1982 when Engine Co. 1 one story building was added. The building consists of 7,412 square feet of conditioned space. The first floor houses Reliable Engine Co. - 2 truck bays, a lounge, a toilet, a radio room and Engine Co. 1 - 1 truck bay. The second floor houses the chief's office, a ladies auxiliary room, a Reliable Fire Co. storage closet, a toilet room, an Engine Co. 1 office, a second floor meeting room.

*Front Façade*

*Partial Rear Façade (typ.)*

*Partial Left Side Façade (typ.)*

*Partial Right Side Façade (typ.)*

### 2.2. Building Occupancy Profiles

Occupancy at the George Street Firehouse is sporadic, usually 2 and up to 5 volunteers for approximately 4 hours per day. There is usually one special event / training held in the meeting room or lounge every couple of months for volunteer firemen members.

### 2.3. Building Envelope

Due to favorable weather conditions (min. 20 deg F delta-T in / outside & no / low wind) some exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging/ infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

*General Note:* All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual and thermal analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

### 2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer with a stone base and some limestone type accents over 3-1/2" framing with 3 inches of fiberglass batt cavity insulation. Other areas are constructed of a stucco covered substrate over concrete block / framing with 3 inches of fiberglass batt cavity insulation. The interior is mostly painted gypsum wallboard and painted exposed concrete blocks.

*Note:* Wall insulation levels could not be verified in the field or on construction plans and are based upon similar wall types at time of construction.

During the field audit, exterior and interior wall surfaces were inspected. They were found / reported to be in overall acceptable / age appropriate condition with a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues located mostly at the side(s) of the building.

The following specific exterior wall problem spots and areas were identified:

*Rusted / deteriorated steel lintel.*

*Cracked / deteriorated mortar joints*

*Deteriorated mortar joints*

*Un-caulked / unsealed exterior wall penetrations*

In light of the exterior wall conditions mentioned above, SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*:

1. Re-point deteriorated mortar joints soon to prevent possible water / moisture penetration into cavity walls.

2. Rusted / deteriorated steel lintels need to be repaired or replaced before water / moisture can penetrate further into the wall cavity.

3. Apply appropriate air-sealing strategies around all exterior wall penetrations (incl. electrical, plumbing and HVAC).

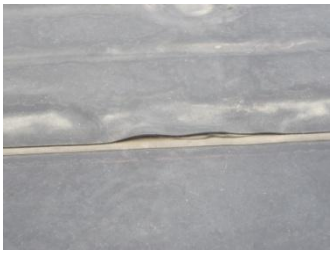
### 2.3.2. Roof

The building's roof is predominantly a low pitched / flat and parapet type over steel decking with a light-colored EPDM single-membrane finish. It was replaced approximately 5 years ago. Little and uneven detectable / assumed attic / ceiling and 2-1/2 inches of foam board roof insulation were recorded.

Note: Roof insulation levels could visually be verified in the field by non-destructive methods.

During the field audit roofs, related flashing, gutters and downspouts were inspected. They were found / reported to be in overall acceptable condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues mostly detected on low pitched flat roof areas.

The following specific roof problem spots and areas were identified:



*Delaminating roof membrane / patches*

*Sagging acoustic ceiling tiles in most areas*

In light of the roof conditions mentioned above, SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*:

1. Repair / patch delaminated roof membrane area.

2. Sagging acoustic ceiling tiles are a sign of high interior humidity levels (due to possibly insufficient fresh air ventilation) either below or above the ceiling plenum. See mechanical section of this report for more information.

### 2.3.3. Base

The building's base is composed of a slab-on-grade floor with a foundation type and no detectable slab edge / perimeter insulation.

Slab / perimeter insulation levels could not be verified in the field or on construction plans and are based upon similar wall types at time of construction.

The building's base and its perimeter were inspected. Judging from signs of uncontrolled moisture or water presence and other energy compromising issues, overall the base was found / reported to be in acceptable / age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

In light of the base conditions mentioned above, SWA has no recommendations at this time.

### 2.3.4. Windows

The building contains two different types of windows.

1. Slider type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices . They are located throughout the building and were replaced approximately 15 years ago
2. Double-hung type windows with a vinyl frame clear double glazing and no interior or exterior shading devices. They are located throughout the building.

Windows, shading devices, sills, related flashing and caulking were inspected from the exterior and interior as far as accessibility allowed. Based on signs of moisture, air-leakage and other energy compromising issues, overall the windows were found and/or reported to be in acceptable condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

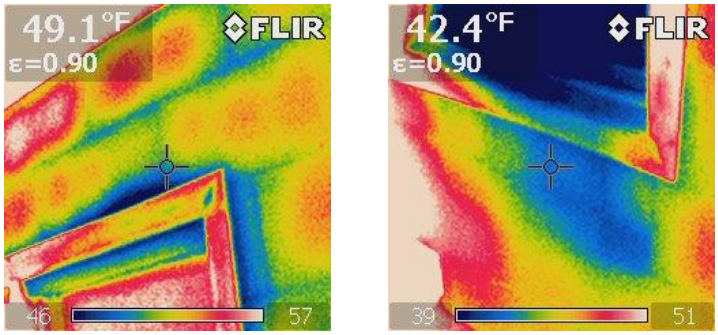
The following specific window problem spots and areas were identified:

*Single glazed window with ineffective frame*

*Air-leakage at sleeved window / wall air-conditioning units*

*Air-leakage at sleeved window / wall air-conditioning units*

The following IR images further visualize some of the window issues mentioned above:




*Air-leakage around windows*

In light of the window conditions mentioned above, SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*:

1. Openings around window air conditioning units need airtight gaskets / sealants for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option.

2. Replace all original / single glazed windows with double glazed, low-E type with the next major renovation.

3. Install / replace / maintain sealants and caulk at all windows for airtight performance.

### 2.3.5. Exterior Doors

The building contains basically two different types of exterior doors.

1 Metal type exterior doors with glass inserts - They are located throughout the building and were replaced during the last renovation.
2 Overhead type exterior doors - They are located in the front of the building and were also replaced during the last renovation.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected. Based on signs of moisture, air-leakage and other energy compromising issues, overall the doors were found/ reported to be in acceptable condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

The following specific door problem spots and areas were identified:

Missing / worn weather stripping

In light of the door conditions mentioned above SWA has the following recommendation, which is further outlined and categorized in the *Executive Summary*:

1. Install / replace / maintain weather stripping around all exterior doors and roof hatches.

### 2.3.6. Building Air Tightness

Overall, the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail in section *2.3. Building Envelope.*

In addition to all the above mentioned findings SWA recommends air sealing, caulking and / or insulating around all structural members, recessed lighting fixtures, electrical boxes that are part of or penetrate the exterior envelope and where air-leakage can occur.

The air tightness of buildings helps maximize all other implemented energy measures and investments and minimizes potentially costly long term maintenance / repair / replacement expenses.

## 2.4. HVAC Systems

The George Street Firehouse heating is provided by a number of individual wall electric heaters in meeting rooms and offices, while the truck bays are heated by ceiling hung gas heaters. Cooling of several offices is provided by window and wall units with the first floor lounge cooled / heated by a rooftop heat pump system.

### 2.4.1. Heating

The building is heated by approximately 9 wall electric heaters, each controlled by local manual knobs. These emitters are located in the meeting room, offices, bathrooms, stairwell and corridors. They are very old and past their expected useful operating lives. There weren't many complaints about the ability of the heating system to provide adequate comfort to the building occupants. SWA recommends replacement with updated units controlled by programmable thermostats. The building, including the truck bays, is generally maintained at 62 deg F when unoccupied. SWA was told that this is the optimum temperature to startup the truck diesel engines and also provide an easy recovery to higher temperatures as activities may need to ramp up.

Heating to the truck bays is provided by 4 Reznor ceiling hung gas fired heaters, each capable of 100 MBtu/hr input, 80% efficient, installed in 2008 and having approximately 90% left of their expected service lives of 15 years.

The first floor lounge / bar is heated / cooled by a Carrier heat pump system. More information is in the Cooling section below.


*Rusted and old wall electric coil heating emitters*


*Truck bay Reznor gas heaters*

### 2.4.2. Cooling

The George Street Firehouse cooling of several offices, upstairs meeting room and radio room is provided by window or through the wall air conditioning units by Hotpoint and Frigidaire. Some of these units are old and past their expected useful lives and SWA recommends replacing them with Energy Star models of high efficiency rating.

The first floor lounge / bar is heated / cooled by a Carrier rooftop heat pump system. It was installed in 2009 and has approximately 90% left of its expected service life of 15 years.

*Lounge / bar rooftop Carrier heat pump*

### 2.4.3. Ventilation

Various spaces within the building are naturally ventilated and some are forced ventilated by the air conditioning units that serve the meeting room, offices and the rooftop heat pump as described in the “Cooling” section above. There may not be sufficient fresh air brought into the building (and stale air exhausted) thus allowing too much humidity inside the building. The exhaust from the fire trucks is captured via rapid disengaging hoses and ducted to a rooftop exhaust fan operated only when the trucks are warmed up to leave.

*Rooftop fan to vent fire truck exhaust*

### 2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the George Street Firehouse is provided by an A. O. Smith electric heater with 50 gal storage. The heater was replaced in 2004 and SWA recommends that next time it be replaced with a high efficiency gas fired, Energy Star, condensing type unit.

## 2.5. Electrical systems

### 2.5.1. Lighting

*Interior Lighting* - The interior lighting of the George Street Firehouse consists of T8 fluorescent fixtures with electronic ballasts, T12 fluorescent fixtures with magnetic ballasts, and incandescent lights. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing the T12 fixtures with T8 fixtures. SWA does not recommend installing occupancy sensors, since the payback on savings are not justified. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

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

*Exterior Lighting* - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) and Incandescent lamp fixtures. Exterior lighting is controlled by automatic timers. SWA recommends replacing the Metal Halide lamps with Compact Fluorescents (CFL). SWA is not recommending at this time any upgrades to the exterior timers.

### 2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the “Products” section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions (DVDs, stereos, computers, and kitchen appliances which now have internal memories or clocks which always require a trickle of power) use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The building computers are generally NOT programmed for the power save mode, to shut down after a period of time that they have not been used.

### 2.5.3. Elevators

The George Street Firehouse does not have an elevator.

### 2.5.4. Others electrical systems

Besides a few very small transformers and an Onan 12 kW emergency generator (located outside and at the back of the firehouse), there are not currently any other significant energy

impacting electrical systems installed at the George Street Firehouse. The generator has 50% left of its expected service life.

### 3. EQUIPMENT LIST (Inventory)

| Building System | Description | Location | Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating | (4) ceiling hung gas shop heaters, each 100 MBH input, 80 MBH output, fan 1050 RPM, 2.3 amps - 80% est. htg. eff. | 2 in each truck bay | Reznor Aerotherm F 1003; Serial #s: B61319BN94466X, inaccessible on the other 3 units | Natural Gas / Electric - fan | truck bays | 2008 | 90% |
| Heating | 9 electric heat emitters throughout the building set a min temp | throughout the building outside truck bays, in bathrooms, stairwell, 2nd flr meeting room, 2nd fl. offices | nametags could not be located | Electric | spaces throughout the building outside truck bays | 1982 | 0% |
| Heating | Stand alone upright wall electric heater | 2nd flr big mtg room | Chromalox | Electric | 2nd flr big mtg room | 1982 | 0% |
| Cooling | window AC unit | 2nd flr big mtg room | Frigidaire | Electric | 2nd flr big mtg room | 2000 | 30% |
| Cooling | window AC unit | Chief's office | missing nametag | Electric | Chief's office | 2005 | 70% |
| Cooling | wall mounted AC unit | Radio Rm | Hotpoint | Electric | Radio Rm | 1982 | 0% |
| Heating / Cooling | (1) heat pump in lounge / bar - roof top unit (Carrier) | rooftop | Carrier with 1/4 HP fan @ 1100 RPM | Electric | Lounge | 2009 | 90% |
| Ventila-tion | truck exhaust fan - 70% est. eff., 5 HP, 3450 RPM motor | rooftop | fan - driven by Baldor motor M3613T | Electric | trucks via exhaust hoses | 2000 | 30% |
| Ventila-tion | 1 big mushroom fan on timer not being used since smoking is banned in the building | mtg area | missing nametag | Electric | use disconti-nued | 1982 | 0% |
| Domestic Hot Water | one 50 gal electric DHW htr, Energy Star usage 5047 kWh/yr vs. a max of 5109 kWh/yr, upper element is 4,500 Watts, lower element is 4,500 Watts - 90% est. eff. | downstairs janitor's closet | A. O. Smith EES 52 917; Serial #: MJ01-1201437-917 | Electric | Firehouse | 2004 | 60% |
| Genera-tor | one 12 kW natural gas generator | exterior | Onan RS12000 with Cummins engine | Natural Gas / Electric | Firehouse emergen-cy backup systems | 2000 | 50% |
| Air Com-pressor | one IR air compressor - serves Horn and other firehouse maintenance activities | garage | Ingersoll-Rand air compressor, Serial #0808060124 230V Motor 7.5 HP & 1470 rpm | Natural Gas / Electric | Firehouse | 2009 | 100% |
| Lighting | See details - Appendix A | See Appendix A | See Appendix A | Electric | Firehouse | 2002 | 50% |

**Note:** The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

## 4. ENERGY CONSERVATION MEASURES

Based on the assessment of the South River George Street Firehouse, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements - Upgrades not directly associated with energy savings
2. Operations and Maintenance - Low Cost / No Cost Measures
3. Energy Conservation Measures - Higher cost upgrades with associated energy savings

### Category I Recommendations: Capital Improvements

- Replace common area heating equipment - such as finned tube radiation and cabinet unit heaters in the toilet rooms, vestibules, corridors and meeting room. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended along with programmable thermostats and upgrades to other portions of the heating system. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace window air conditioners - A couple of the existing window air conditioners have little useful life remaining (on the average 0-3 years left) but replacement should be considered with more modern, energy efficient systems. The window air conditioners should be replaced with split systems to allow for closing up of the existing window / wall penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- Replace all original / single glazed windows with double glazed, low-E type with the next major renovation.

### Category II Recommendations: Operations and Maintenance

- Maintain / repair garage doors so that they fully close and are sealed all around.

- Thoroughly and evenly insulate space above the second floor ceiling and plug all ceiling penetration.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Repair / patch delaminated roof membrane areas.

- Maintain downspouts and cap flashing - Repair / install missing downspouts and cap flashing as needed to prevent water / moisture infiltration and insulation damage.

- Provide weather stripping / air sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Openings around window air conditioning

units need airtight gaskets / sealants for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair / seal wall cracks and penetrations - SWA recommends as part of the maintenance program to install proper flashing, seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective. Re-point deteriorated mortar joints soon to prevent possible water / moisture penetration into cavity walls. Rusted / deteriorated steel lintels need to be repaired or replaced before water / moisture can penetrate further into the wall cavity. Apply appropriate air-sealing strategies around all exterior wall penetrations (incl. electrical, plumbing and HVAC).

- Provide water efficient fixtures and controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize their energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: http://www1.eere.energy.gov/education/ .

**Category III Recommendations: Energy Conservation Measures - Summary Table**

| ECM# | Description of Highly Recommended 0-5 Year Payback ECMs |
|---|---|
| 1 | install Drinks vending machine energy misers |
| 2.1 | replace incandescent and Metal Halide lamps with CFLs |
| | Description of Recommended 5-10 Year Payback ECMs |
| 3 | replace old refrigerator with Energy Star type model |
| | Description of Recommended End of Life Cycle ECMs |
| 2.2 | replace T12 (with magnetic ballasts) with T8 (with electronic ballasts) fixtures |
| 4 | replace old bar ice maker with Energy Star type model |
| | Description of Renewable ECMs |
| 5 | install a 5 kW solar PV rooftop system |

## ECM#1: *Install Vending Misers*

**Description:**

The George Street Firehouse has two Drinks vending machines located in the Radio and back rooms. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snacks vending miser devices can be used on Snacks vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snacks vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

**Installation cost:**

Estimated installed cost: $558 (includes $200 of labor)
Source of cost estimate: www.usatech.com *and established costs*

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | install (2) Drinks vending machine energy misers - in radio and back rooms | www.usatech.com and established costs | 558 | 0 | 558 | 2,912 | 0.6 | 0 | 1.3 | 0 | 379 | 12 | 4,543 | 1.5 | 714 | 60 | 68 | 3,067 | 5,214 |

**Assumptions:** SWA assumes energy savings based modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

**Rebates/financial incentives:**

*This measure does not qualify for a rebate or other financial incentive at this time.*

*This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.*

*http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html*

## ECM#2: *Building Lighting Upgrades*

**Description:**

On the days of the site visits, SWA completed a lighting inventory of the George Street Firehouse (see Appendix A). The interior lighting of the George Street Firehouse consists of T8 fluorescent fixtures with electronic ballasts, T12 fluorescent fixtures with magnetic ballasts (which are operating beyond their estimated useful lives and are starting to require increased maintenance), and incandescent lights. SWA recommends replacing the T12 fixtures with T8 fixtures. SWA does not recommend installing occupancy sensors, since the payback on savings are not justified. The exterior lighting surveyed was found to be a mix of Metal Halide (MH) and Incandescent lamp fixtures. SWA recommends replacing the Metal Halide lamps with Compact Fluorescents (CFL). See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of South River may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

**Installation cost:**

Estimated installed cost: $12,195 (includes $8,179 of labor)
Source of cost estimate: RS *Means; Published and established costs*

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | replace (4) incandescent and (12) Metal Halide bulbs with CFLs | RS Means, Lit Search | 800 | 0 | 800 | 2,902 | 0.6 | 0 | 1.3 | 53 | 430 | 5 | 2,149 | 1.9 | 169 | 34 | 45 | 1,121 | 5,196 |
| | | | | | | | | | | | | | | | | | | | |
| 2.2a | replace (53) T12 fixtures throughout the bldg with new T12 fixtures | RS Means, Lit Search | 10,600 | 0 | 10,600 | 0 | 0.0 | 0 | 0.0 | 175 | 175 | 15 | 2,625 | 60.6 | -75 | -5 | -14 | -8,276 | 0 |
| 2.2b | incremental difference to replace (53) T12 fixtures throughout the bldg with new T8 fixtures | RS Means, Lit Search | 795 | 0 | 795 | 3,744 | 0.8 | 0 | 1.7 | 70 | 557 | 15 | 8,351 | 1.4 | 950 | 63 | 70 | 5,577 | 6,704 |
| 2.2 (a+b) | replace (53) T12 fixtures throughout the bldg with new T8 fixtures | RS Means, Lit Search | 11,395 | 0 | 11,395 | 3,744 | 0.8 | 0 | 1.7 | 245 | 732 | 15 | 10,976 | 15.6 | -4 | 0 | 0 | -2,698 | 6,704 |

**Assumptions:** SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 8.5 hr/yr to replace aging burnt out lamps vs. newly installed.

**Rebates / Financial Incentives:**

*NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

**Options for Funding ECM:**

*This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.*

*http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html*

## ECM#3: *Replace Old Refrigerator with an Energy Star Model*

**Description:**

On the day of the site visit, SWA observed that there was an old refrigerator in the Ladies Auxiliary Room which was not Energy Star rated (using approximately 773 kWh/yr). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerator with 18.2 cu. ft. top freezer refrigerator ENERGY STAR®, Mfr. model #6897, 407 kWh / yr, or equivalent. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

**Installation cost:**

Estimated installed cost: $750 (includes $70 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3a | replace (1) old Ladies Aux room refrigerator with an 18 cu ft model in kind | Energy Star purchasing and procurement site, similar projects | 700 | 0 | 700 | 50 | 0.0 | 0 | 0.0 | 50 | 57 | 12 | 678 | 12.4 | -3 | 0 | 0 | -140 | 90 |
| 3b | incremental difference to replace (1) old Ladies Aux room refrigerator with an 18 cu ft Energy Star model | Energy Star purchasing and procurement site, similar projects | 50 | 0 | 50 | 300 | 0.1 | 0 | 0.1 | 0 | 39 | 12 | 468 | 1.3 | 836 | 70 | 78 | 323 | 537 |
| 3 (a+b) | replace one (1) Ladies Aux room refrigerator with an 18 cu ft Energy Star model | Energy Star purchasing and procurement site, similar projects | 750 | 0 | 750 | 350 | 0.1 | 0 | 0.2 | 50 | 96 | 12 | 1,146 | 7.9 | 53 | 4 | 7 | 183 | 627 |

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis.

**Rebates/financial incentives:** *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

**Options for Funding ECM:**

*This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.*
*http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html*

## ECM#4: *Replace Old Ice Maker with an Energy Star Model*

**Description:**

On the day of the site visit, SWA observed that there was an old ice maker in the bar area which was not Energy Star rated (using approximately 5,000 kWh/yr). Appliances, such as ice makers, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing ice maker with an equivalent 500 lbs/day, however Energy Star Efficient Prodigy™ which produces ice cubes with significantly less energy and water than other cube ice machines, exceeding California and Federal energy efficiency regulations, which has WaterSense™ patented adaptive purge control that delivers maximum reliability by reducing scale buildup for a longer time between cleanings and also Auto-Alert™ indicator lights that constantly communicate about operating status and actually signal staff when it's time to de-scale and sanitize. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

**Installation cost:**

Estimated installed cost: $2,800 (includes $240 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4a | replace (1) old bar icemaker model in kind | Energy Star purchasing and procurement site, similar projects | 2,400 | 0 | 2,400 | 50 | 0.0 | 0 | 0.0 | 50 | 57 | 12 | 678 | 42.5 | -72 | -6 | -16 | -1,787 | 90 |
| 4b | incremental difference to replace (1) old bar icemaker with an Energy Star model | Energy Star purchasing and procurement site, similar projects | 400 | 0 | 400 | 750 | 0.2 | 0 | 0.3 | 0 | 98 | 12 | 1,170 | 4.1 | 193 | 16 | 22 | 542 | 1,343 |
| 4 (a+b) | replace one (1) old bar icemaker with an Energy Star model | Energy Star purchasing and procurement site, similar projects | 2,800 | 0 | 2,800 | 800 | 0.2 | 0 | 0.4 | 50 | 154 | 12 | 1,848 | 18.2 | -34 | -3 | -6 | -1,245 | 1,432 |

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis.

**Rebates/financial incentives:** *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

**Options for Funding ECM:**

*This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.*
*http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html*

## ECM#5: *Install a 5 kW PV System*

**Description:**

Currently the George Street Firehouse does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. The Borough of South River may want to review installing a 5 kW PV system to offset electrical demand and reduce the annual net electric consumption for the George Street Firehouse. The George Street Firehouse is not eligible for a 30% federal tax credit, applicable to residential buildings. The George Street Firehouse may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. See below for more information.

Considering the available square footage of the George Street Firehouse roof at this time, it would be possible to install a 50 kW PV system. However, considering the facts that:

- the solar PV system should be limited in size to below the minimum electrical demand since the utility will not buy back excess power generated by the system
- the solar PV system installation cost should be limited to allow for available grant money to considerably shorten the payback period

SWA is only recommending a 5kW PV system. Should the George Street Firehouse decide to increase the air conditioned spaces, the minimum demand would increase over the historical data cited in this analysis, and therefore further study into expanding the proposed system would be recommended.

There are many possible locations for a 5 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 5 kW system needs approximately 22 panels which would take up 380 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

**Installation cost:**

Estimated installed cost: $37,500 (includes $15,000 of labor)
Source of cost estimate: Similar Projects

**Economics (without NJ EECBG Grant):**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Install a 5 kW Solar Photovoltaic system | Similar Projects | 37,500 | 0 | 37,500 | 5,902 | 5.0 | 0 | 2.7 | 0 | 767 | 25 | 19,182 | 48.9 | 0 | 0 | -5 | -23,675 | 10,568 |

**Assumptions:** SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

**Rebates/financial incentives:**

*NJ Clean Energy rebates are not available since the South River Utility is part of an energy consortium that does not pay the Societal Benefits Charge that funds these rebates.*

*NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. An estimated SREC value of $3,000 could be realized with a traditional solar PV system setup. However, since net metering is not available from the local utility, savings in the form of SRECs were NOT incorporated into the above analysis.*

**Options for funding ECM:**

*This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.*
*http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html*

## 5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

### 5.1. Existing systems

There aren't currently any existing renewable energy systems.

### 5.2. Wind

**Description:**

*A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.*

### 5.3. Solar Photovoltaic

**Description:**

*A Solar PV System is not applicable because of insufficient financial incentives and a simple payback greater than 40 years. See ECM#5.*

### 5.4. Solar Thermal Collectors

**Description:**

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

### 5.5. Combined Heat and Power

**Description:**

*CHP is not applicable for this building because of insufficient domestic hot water use.*

### 5.6. Geothermal

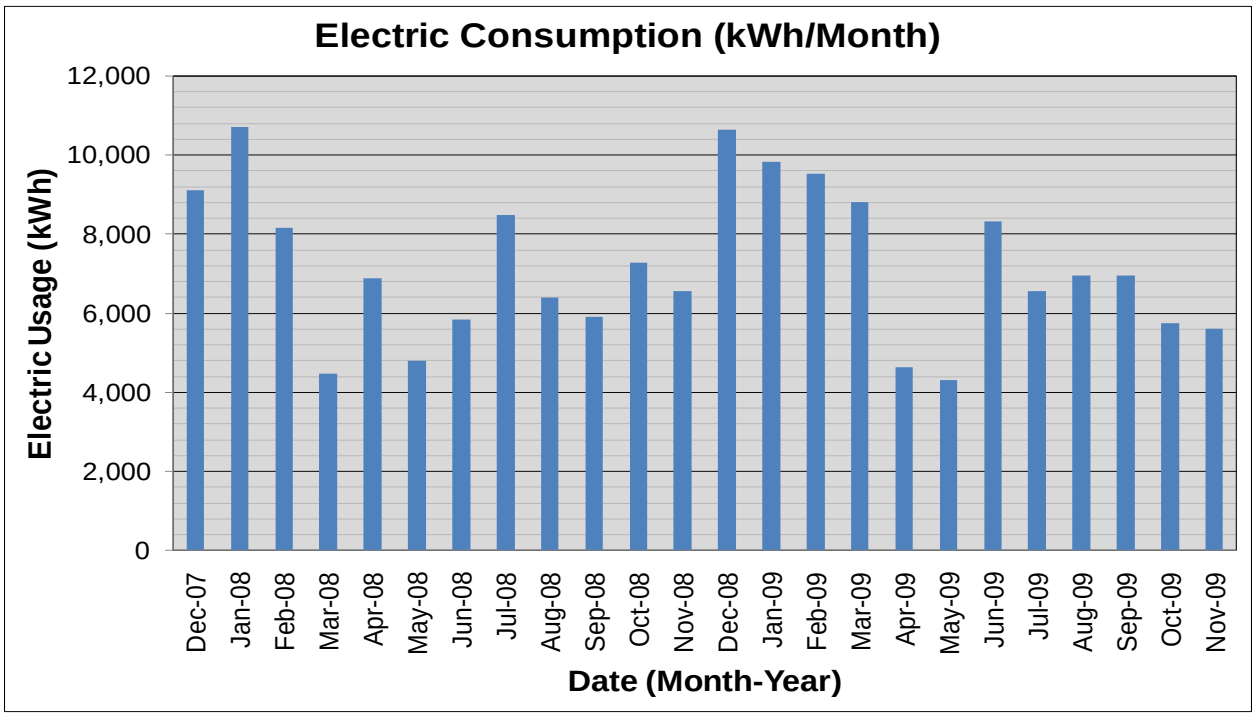
**Description:**

*Geothermal is not applicable for this building because it would not be cost effective, since it would require replacement of the entire HVAC system.*

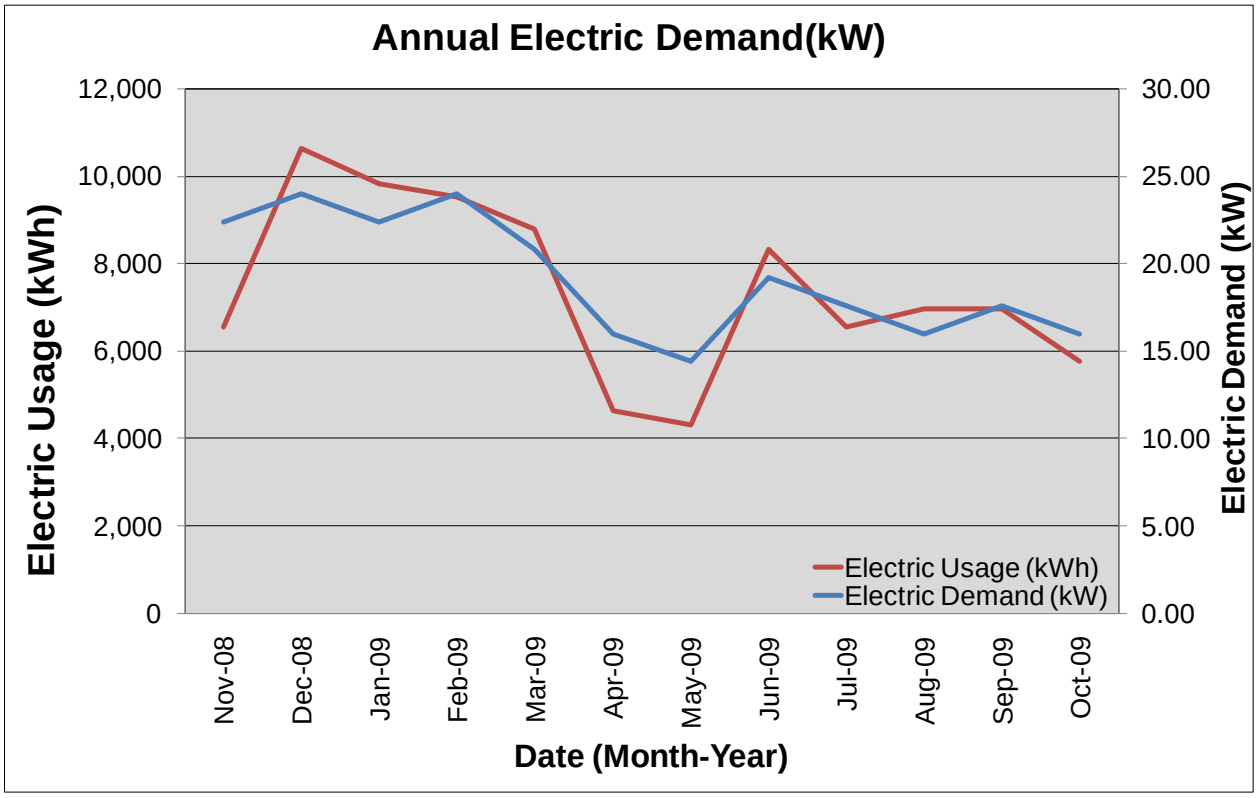
## 6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

### 6.1. Load Profiles

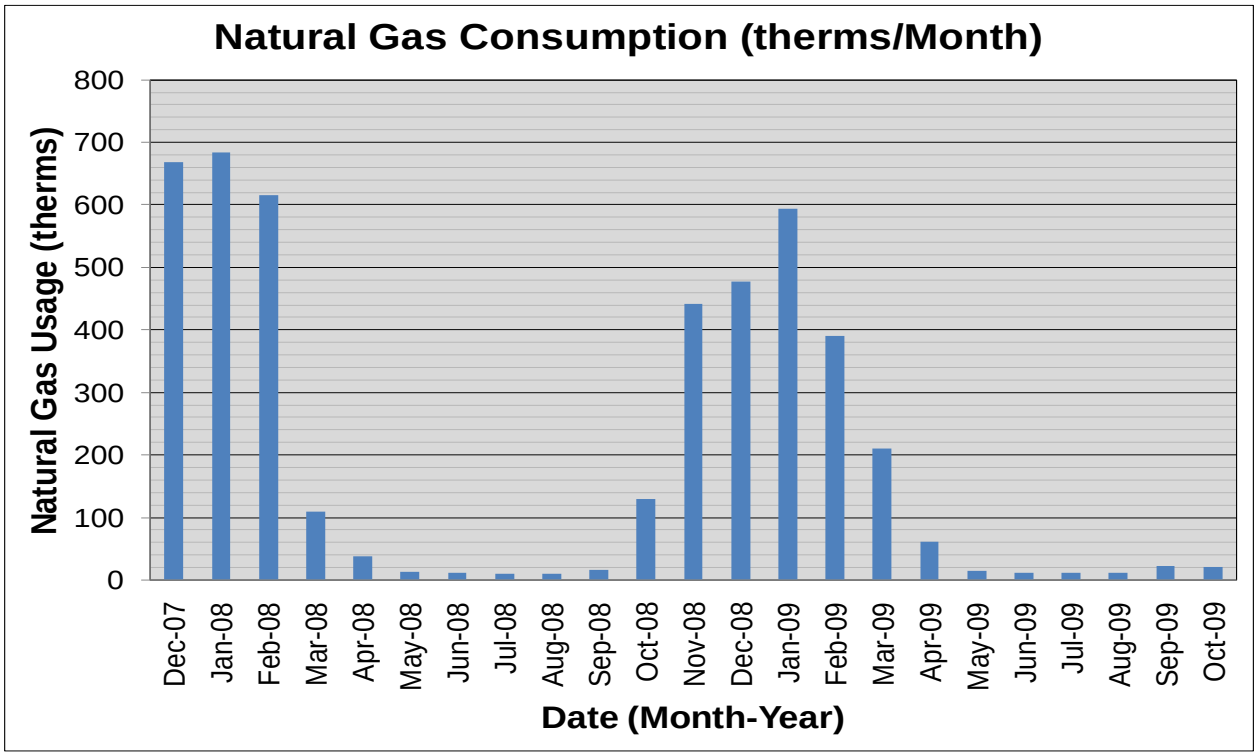
The following are charts that show the annual electric and natural gas load profiles for the South River George Street Firehouse. For annual electric and natural gas usage please also see Section 1. Historic Energy Consumption.

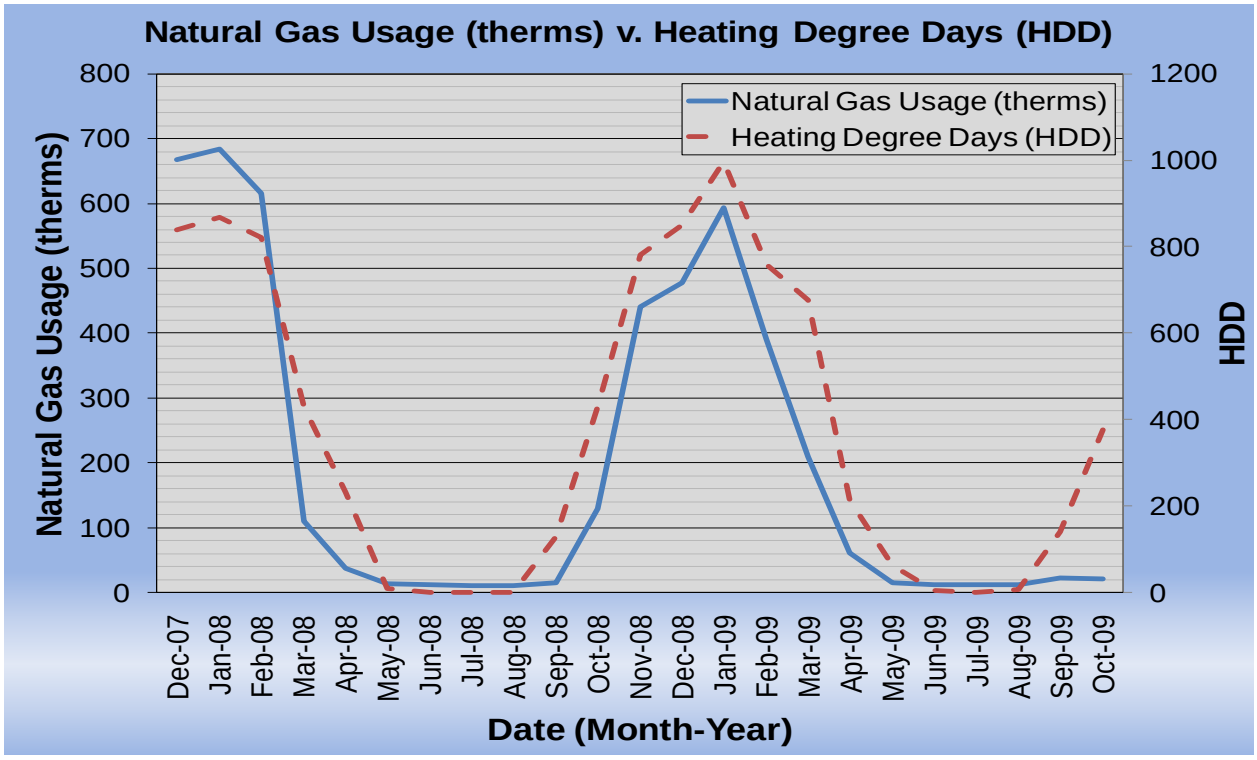



Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



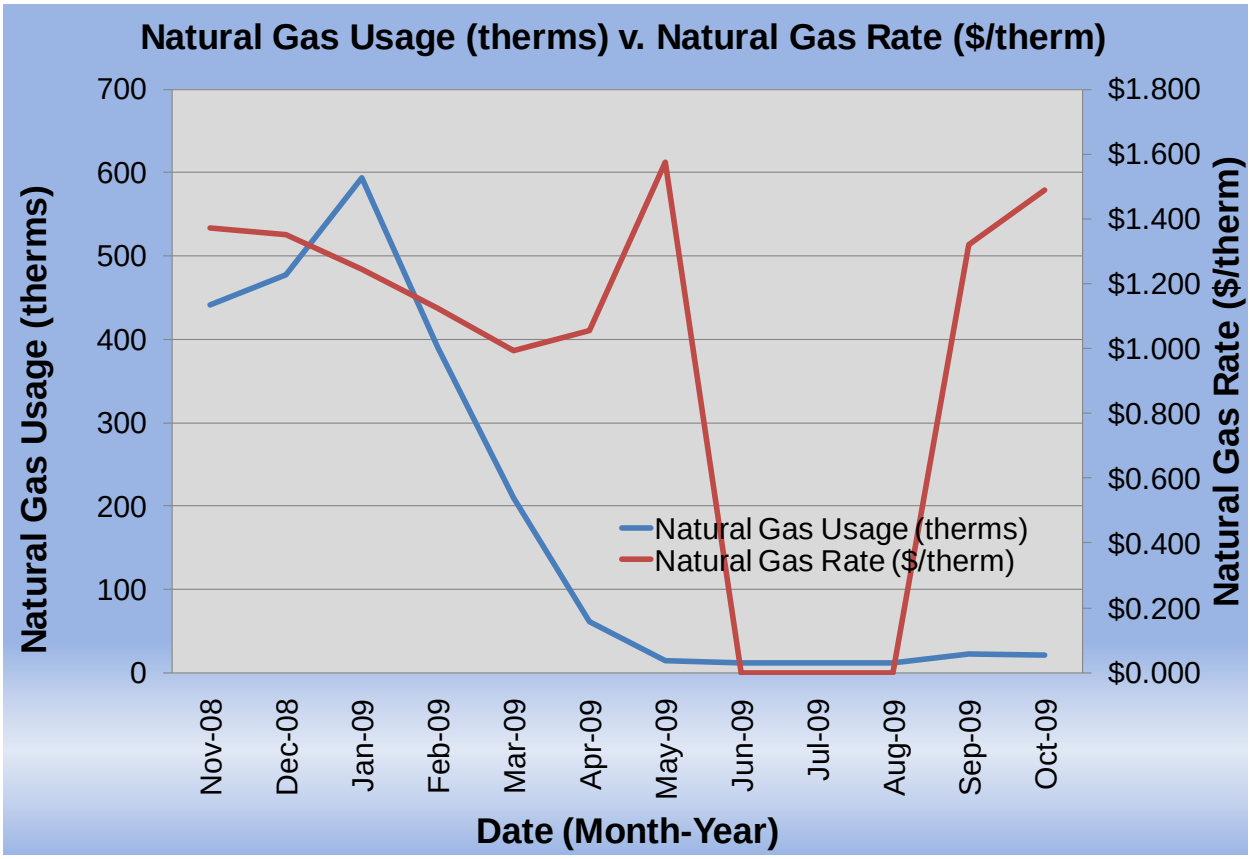
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



### 6.2. Tariff Analysis

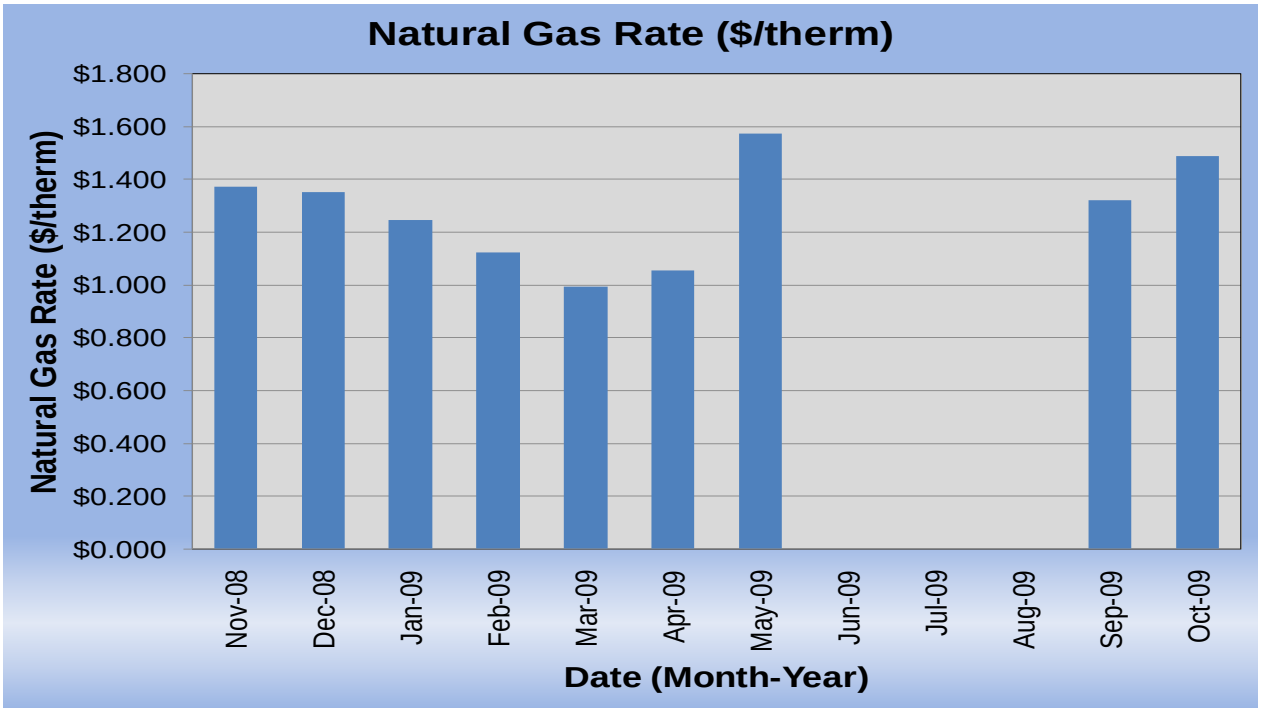
Currently, natural gas is provided to the George Street Firehouse via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by PSE&G at a general and very competitive service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the George Street Firehouse billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the furnace units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. Some of the cap payments are excluded from the following chart.




The George Street Firehouse is direct-metered and currently purchases electricity from the South River Electric Utility at a general service rate. The general service rate for electric charges is market-rate based on use and the George Street Firehouse does not track a breakdown of demand costs. Demand prices are generally reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

### 6.3. Energy Procurement Strategies

The George Street Firehouse receives natural gas via one incoming meter. PSE&G supplies the gas and transports it. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the main George Street Firehouse from South River Electricity Company without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric rates were estimated by the Borough of South River over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 18% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and recent escalating energy costs. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The George Street Firehouse annual utility costs are competitive when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of South River further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the George Street Firehouse. Appendix B contains a complete list of third party energy suppliers for the Borough of South River service area. The Borough of South River may want to consider partnering with other school districts, municipalities, boroughs and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. Also, the George Street Firehouse would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. The following chart show the George Street Firehouse monthly natural gas spending per unit of energy in 2009. Electric rates were estimated by the Borough at a constant rate of $0.130/kWh.



## 7. METHOD OF ANALYSIS

### 7.1. Assumptions and tools

| | |
|---|---|
| Energy modeling tool: | established / standard industry assumptions, E-Quest |
| Cost estimates: | RS Means 2009 (Facilities Maintenance & Repair Cost Data)<br>RS Means 2009 (Building Construction Cost Data)<br>RS Means 2009 (Mechanical Cost Data)<br>Published & established specialized equipment material & labor costs<br>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

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 1 | GF | Garage Bay #1 | Parabolic | M | 4'T12 | 18 | 2 | 40 | S | 6 | 365 | 15 | 1,710 | 3,745 | T8 | Parabolic | 4'T8 | E | S | 18 | 2 | 32 | 6 | 365 | 6 | 1260 | 2759 | 986 | 0 | 986 |
| 2 | GF | Garage Bay #1 | Exit Sign | N | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | N | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 3 | GF | Radio Room | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 6 | 365 | 6 | 140 | 307 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 6 | 365 | 6 | 140 | 307 | 0 | 0 | 0 |
| 4 | GF | Storage Rm | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 365 | 6 | 70 | 51 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 365 | 6 | 70 | 51 | 0 | 0 | 0 |
| 5 | GF | Ready Room | Recessed | M | 4'T12 | 4 | 2 | 40 | S | 6 | 365 | 15 | 380 | 832 | T8 | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 6 | 365 | 6 | 280 | 613 | 219 | 0 | 219 |
| 6 | GF | Ready Room | Recessed | N | Inc | 7 | 1 | 65 | N | 6 | 365 | 0 | 455 | 996 | C | Recessed | CFL | N | S | 7 | 1 | 23 | 6 | 365 | 0 | 161 | 353 | 644 | 0 | 644 |
| 7 | GF | Ready Room | Exit Sign | N | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | N | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 8 | GF | Storage Closet | Screw-in | N | Inc | 1 | 1 | 60 | S | 2 | 365 | 0 | 60 | 44 | CFL | Screw-in | CFL | N | S | 1 | 1 | 20 | 2 | 365 | 0 | 20 | 15 | 29 | 0 | 29 |
| 9 | GF | Hallway | 2'U-shape | M | 4'T12 | 2 | 2 | 40 | S | 6 | 365 | 15 | 190 | 416 | T8 | 2'U-Shape | 4'T8 | E | S | 2 | 2 | 32 | 6 | 365 | 6 | 140 | 307 | 110 | 0 | 110 |
| 10 | GF | Storage Rm | Screw-in | N | Inc | 1 | 1 | 60 | S | 2 | 365 | 0 | 60 | 44 | CFL | Screw-in | CFL | N | S | 1 | 1 | 20 | 2 | 365 | 0 | 20 | 15 | 29 | 0 | 29 |
| 11 | GF | Garage Bay # 2 | Recessed | M | 4'T12 | 8 | 4 | 40 | MS | 6 | 365 | 24 | 1,472 | 3,224 | T8 | Recessed | 4'T8 | E | MS | 8 | 4 | 32 | 6 | 365 | 13 | 1128 | 2470 | 753 | 0 | 753 |
| 12 | GF | Garage Bay # 2 | Exit Sign | N | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | N | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 13 | GF | Bathroom | Parabolic | M | 4'T12 | 1 | 1 | 40 | S | 6 | 365 | 12 | 52 | 114 | T8 | Parabolic | 4'T8 | E | S | 1 | 1 | 32 | 6 | 365 | 3 | 35 | 77 | 37 | 0 | 37 |
| 14 | GF | Staircase | 2'U-shape | M | 4'T12 | 1 | 2 | 40 | S | 6 | 365 | 15 | 95 | 208 | T8 | 2'U-Shape | 4'T8 | E | S | 1 | 2 | 32 | 6 | 365 | 6 | 70 | 153 | 55 | 0 | 55 |
| 15 | 2 | Staircase | 2'U-shape | M | 4'T12 | 1 | 2 | 40 | S | 6 | 365 | 15 | 95 | 208 | T8 | 2'U-Shape | 4'T8 | E | S | 1 | 2 | 32 | 6 | 365 | 6 | 70 | 153 | 55 | 0 | 55 |
| 16 | 2 | Bathroom | 2'U-shape | M | 4'T12 | 1 | 2 | 40 | S | 6 | 365 | 15 | 95 | 208 | T8 | 2'U-Shape | 4'T8 | E | S | 1 | 2 | 32 | 6 | 365 | 6 | 70 | 153 | 55 | 0 | 55 |
| 17 | 2 | Meeting Rm | Recessed | M | 4'T12 | 12 | 4 | 40 | T | 6 | 365 | 24 | 2,208 | 4,836 | T8 | Recessed | 4'T8 | E | T | 12 | 4 | 32 | 6 | 365 | 13 | 1692 | 3705 | 1130 | 0 | 1130 |
| 18 | 2 | Storage Rm | Screw-in | N | Inc | 1 | 1 | 60 | S | 2 | 365 | 0 | 60 | 44 | CFL | Screw-in | CFL | N | S | 1 | 1 | 20 | 2 | 365 | 0 | 20 | 15 | 29 | 0 | 29 |
| 19 | 2 | Storage Rm #2 | Screw-in | N | Inc | 1 | 1 | 60 | S | 2 | 365 | 0 | 60 | 44 | CFL | Screw-in | CFL | N | S | 1 | 1 | 20 | 2 | 365 | 0 | 20 | 15 | 29 | 0 | 29 |
| 20 | 2 | Kitchen | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 6 | 365 | 24 | 184 | 403 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 6 | 365 | 13 | 141 | 309 | 94 | 0 | 94 |
| 21 | 2 | Office | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 6 | 365 | 24 | 184 | 403 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 6 | 365 | 13 | 141 | 309 | 94 | 0 | 94 |
| 22 | 2 | Office #2 | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 6 | 365 | 24 | 184 | 403 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 6 | 365 | 13 | 141 | 309 | 94 | 0 | 94 |
| 23 | 2 | Storage Rm | Recessed | M | 4'T12 | 2 | 4 | 40 | S | 2 | 365 | 24 | 368 | 269 | T8 | Recessed | 4'T8 | E | S | 2 | 4 | 32 | 2 | 365 | 13 | 282 | 206 | 63 | 0 | 63 |
| 24 | 2 | Meeting Rm | Exit Sign | N | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | N | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 25 | Ext | Exterior | Exterior | N | MH | 8 | 1 | 75 | T | 12 | 365 | 19 | 752 | 3,294 | CFL | Exterior | CFL | N | T | 8 | 1 | 25 | 12 | 365 | 0 | 200 | 876 | 2418 | 0 | 2418 |
| 26 | Ext | Exterior | Exterior | N | MH | 4 | 1 | 25 | T | 12 | 365 | 6 | 124 | 543 | CFL | Exterior | CFL | N | T | 4 | 1 | 10 | 12 | 365 | 0 | 40 | 175 | 368 | 0 | 368 |
| 27 | Ext | Exterior | Exterior | N | Inc | 1 | 1 | 65 | T | 12 | 365 | 0 | 65 | 285 | N/A | Exterior | CFL | N | T | 1 | 1 | 65 | 12 | 365 | 0 | 65 | 285 | 0 | 0 | 0 |
| **Totals:** | | | | | | **87** | **53** | **1,074** | | | | **287** | **9,105** | **21,287** | | | | | | **87** | **53** | **703** | | | **133** | **6,248** | **13,996** | **7,291** | **0** | **7,291** |

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

**Legend:**

| Fixture Type | Lamp Type | Control Type | Ballast Type | Retrofit Category |
|---|---|---|---|---|
| Exit Sign | LED | N (None) | N/A (None) | N/A (None) |
| Screw-in | Inc (Incandescent) | S (Switch) | E (Electronic) | T8 (Installl new T8) |
| Pin | 1'T5 | OS (Occupancy Sensor) | M (Magnetic) | T5 (Install new T5) |
| Parabolic | 2'T5 | T (Timer) | | CFL (Install new CFL) |
| Recessed | 3'T5 | PC (Photocell) | | LEDex (Install new LED Exit) |
| 2'U-shape | 4'T5 | D (Dimming) | | LED (Install new LED) |
| Circiline | 2'T8 | DL (Daylight Sensor) | | D (Delamping) |
| Exterior | 3'T8 | M (Microphonic Sensor) | | C (Controls Only) |
| HID (High Intensity Discharge) | 4'T8 | | | |
| | 6'T8 | | | |
| | 8'T8 | | | |
| | 2'T12 | | | |
| | 3'T12 | | | |
| | 4'T12 | | | |
| | 6'T12 | | | |
| | 8'T12 | | | |
| | CFL (Compact Fluorescent Lightbulb) | | | |
| | MR16 | | | |
| | Halogen | | | |
| | MV (Mercury Vapor) | | | |
| | MH (Metal Halide) | | | |
| | HPS (High Pressure Sodium | | | |
| | LPS (Low Pressure Sodium) | | | |

## Appendix B: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

| PSE&G NATURAL GAS SERVICE TERRITORY<br>Last Updated: 06/15/09 | | |
|---|---|---|
| **Cooperative Industries**<br>412-420 Washington Avenue<br>Belleville, NJ 07109<br>800-6BUYGAS (6-289427)<br>www.cooperativenet.com | **Direct Energy Services, LLP**<br>120 Wood Avenue, Suite 611<br>Iselin, NJ 08830<br>866-547-2722<br>www.directenergy.com | **Dominion Retail, Inc.**<br>395 Highway 170 - Suite 125<br>Lakewood, NJ 08701<br>866-275-4240<br>http://retail.dom.com |
| **Gateway Energy Services Corp.**<br>44 Whispering Pines Lane<br>Lakewood, NJ 08701<br>800-805-8586<br>www.gesc.com | **UGI Energy Services, Inc. d/b/a GASMARK**<br>704 East Main Street, Suite 1<br>Moorestown, NJ 080111<br>856-273-9995<br>www.ugienergyservices.com | **Great Eastern Energy**<br>116 Village Riva, Suite 200<br>Princeton, NJ 08540<br>888-651-4121<br>www.greateastern.com |
| **Hess Energy, Inc.**<br>One Hess Plaza<br>Woodbridge, NJ 07095<br>800-437-7872<br>www.hess.com | **Hudson Energy Services, LLC**<br>920 Route 17 South<br>Ridgewood, NJ 07450<br>877- Hudson 9<br>www.hudsonenergyservices.com | **Intelligent Energy**<br>2050 Center Avenue, Suite 500<br>Fort Lee, NJ 07024<br>800-724-1880<br>www.intelligentenergy.org |
| **Keil & Sons**<br>1 Bergen Blvd.<br>Fairview, NJ 07002<br>1-877-Systrum<br>www.systrumenergy@aol.com | **Metromedia Energy, Inc.**<br>6 Industrial Way<br>Eatontown, NJ 07724<br>877-750-7046<br>www.metromediaenergy.com | **Metro Energy Group, LLC**<br>14 Washington Place<br>Hackensack, NJ 07601<br>888-111-Metro<br>www.metroenergy.com |
| **MxEnergy, Inc.**<br>510 Thornall Street, Suite 270<br>Edison, NJ 088327<br>800-375-1277<br>www.mxenergy.com | **NATGASCO (Mitchell Supreme)**<br>1112 Freeman Street<br>Orange, NJ 07050<br>800-840-4GAS<br>www.natgasco.com | **Pepco Energy Services, Inc.**<br>112 Main Street<br>Lebanon, NJ 08833<br>800-363-7499<br>www.pepco-services.com |
| **PPL EnergyPlus, LLC**<br>811 Church Road - Office 105<br>Cherry Hill, NJ 08002<br>800-281-2000<br>www.pplenergyplus.com | **Sempra Energy Solutions**<br>The Mac-Cali Building<br>581 Main Street, 8th fl.<br>Woodbridge, NJ 07095<br>877-273-6772<br>800-2 SEMPRA<br>www.semprasolutions.com | **South Jersey Energy Company**<br>One South Jersey Plaza, Route 54<br>Folsom, NJ 08037<br>800-756-3749<br>www.sjindustries.com/sje.htm |
| **Sprague Energy Corp.**<br>12 Ridge Road<br>Chatham Township, NJ 011128<br>800-225-1560<br>www.spragueenergy.com | **Stuyvesant Energy LLC**<br>10 West Ivy Lane, Suite 4<br>Englewood, NJ 07631<br>800-646-64111<br>www.stuyfuel.com | **Woodruff Energy**<br>73 Water Street<br>Bridgeton, NJ 08302<br>800-5111-1121<br>www.woodruffenergy.com |

## Appendix C

## Glossary and Method of Calculations

### Glossary of ECM Terms

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**Net ECM Cost:** The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

**Annual Energy Cost Savings (AECS):** This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

**Lifetime Energy Cost Savings (LECS):** This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

**Simple Payback:** This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

**ECM Lifetime:** This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

**Operating Cost Savings (OCS):** This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

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

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

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

## Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

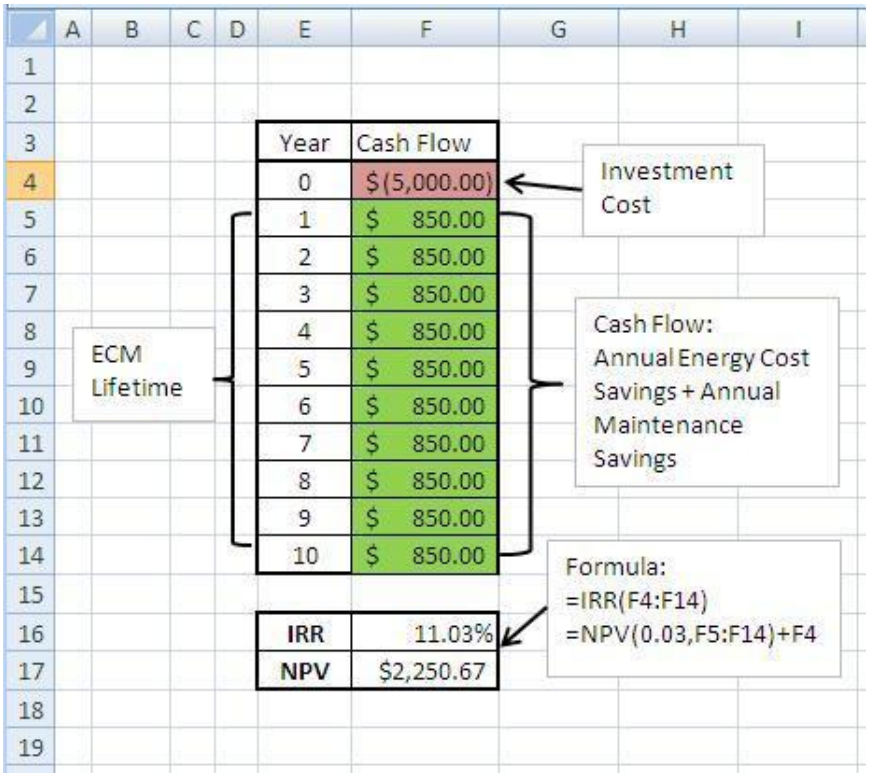
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

## Excel NPV and IRR Calculation

In Excel, function =IRR(values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:




**ECM and Equipment Lifetimes**

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.
Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

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## NJCEP C & I Lifetimes

| Measure | Measure Life |
|---|---|
| Commercial Lighting — New | 15 |
| Commercial Lighting — Remodel/Replacement | 15 |
| Commercial Custom — New | 18 |
| Commercial Chiller Optimization | 18 |
| Commercial Unitary HVAC — New - Tier 1 | 15 |
| Commercial Unitary HVAC — Replacement - Tier 1 | 15 |
| Commercial Unitary HVAC — New - Tier 2 | 15 |
| Commercial Unitary HVAC — Replacement Tier 2 | 15 |
| Commercial Chillers — New | 25 |
| Commercial Chillers — Replacement | 25 |
| Commercial Small Motors (1-10 HP) — New or Replacement | 20 |
| Commercial Medium Motors (11-75 HP) — New or Replacement | 20 |
| Commercial Large Motors (76-200 HP) — New or Replacement | 20 |
| Commercial VSDs — New | 15 |
| Commercial VSDs — Retrofit | 15 |
| Commercial Comprehensive New Construction Design | 18 |
| Commercial Custom — Replacement | 18 |
| Industrial Lighting — New | 15 |
| Industrial Lighting — Remodel/Replacement | 15 |
| Industrial Unitary HVAC — New - Tier 1 | 15 |
| Industrial Unitary HVAC — Replacement - Tier 1 | 15 |
| Industrial Unitary HVAC — New - Tier 2 | 15 |
| Industrial Unitary HVAC — Replacement Tier 2 | 15 |
| Industrial Chillers — New | 25 |
| Industrial Chillers — Replacement | 25 |
| Industrial Small Motors (1-10 HP) — New or Replacement | 20 |
| Industrial Medium Motors (11-75 HP) — New or Replacement | 20 |
| Industrial Large Motors (76-200 HP) — New or Replacement | 20 |
| Industrial VSDs — New | 15 |
| Industrial VSDs — Retrofit | 15 |
| Industrial Custom — Non-Process | 18 |
| Industrial Custom — Process | 10 |
| Small Commercial Gas Furnace — New or Replacement | 20 |
| Small Commercial Gas Boiler — New or Replacement | 20 |
| Small Commercial Gas DHW — New or Replacement | 10 |
| C&I Gas Absorption Chiller — New or Replacement | 25 |
| C&I Gas Custom — New or Replacement (Engine Driven Chiller) | 25 |
| C&I Gas Custom — New or Replacement (Gas Efficiency Measures) | 18 |
| O&M savings | 3 |
| Compressed Air (GWh participant) | 8 |