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*June 28, 2010*

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

# *Palmyra Firehouse*
***Palmyra, NJ 08065***

***Project Number: LGEA49***

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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 Palmyra municipal buildings. The audit, conducted on March 2, 2010 included a review of the:

- Borough Hall
- Palmyra Firehouse

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

This report addresses the Palmyra Firehouse located at 115 West Broad Street, Palmyra, NJ 08065. 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 (including a partial basement), 10,500 square feet Palmyra Firehouse was originally constructed in the early 1900s with additions/alterations performed in 1956, 1990 and 1995. It houses on the first floor: storage rooms, locker rooms, bathrooms, a Ready room with bar, a Ladies meeting room and kitchenette, a commercial kitchen, truck bays for 3 gas fire engines, 4 diesel fire engines and 2 gas boats. The front second floor houses a meeting room, offices, an uniform locker room, a bathroom and display cases. The back second floor houses a recreation room, a furnace room and a bathroom. The boiler room is in the partial basement located under the ladder truck bay. There are 14 double size garages at the rear of the firehouse that are rented out as storage space. Occupancy for the Palmyra Firehouse building is approximately 3-5 volunteers (of a total of 40) for 20 hours a week. There is usually one special recreational event held every couple of months for the volunteer fire department members. The Independence Fire Company No. 1 has approximately 300 annual call-outs.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of Palmyra to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the 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 Palmyra Firehouse located at 115 West Broad Street, Palmyra, NJ 08065. The Firehouse is a two-story (including a partial basement) building, comprising of a total conditioned floor area of 10,500 square feet. The original structure was built in the early 1900s with additions/alterations performed in 1956, 1990 and 1995.

Based on the field visits performed by the SWA staff on March 2, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, natural gas and electric usage.

From March 2009 through February 2010 the Firehouse consumed 44,729 kWh or $8,902 worth of electricity at an approximate rate of $0.199/kWh and 5,228 therms or $5,974 worth of natural gas at an approximate rate of $1.143/therm. The joint energy consumption for the building, including both electricity and natural gas, was 675 MMBtu of energy that cost a total of $14,876.

SWA has entered energy information about the Firehouse in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is a Fire Station and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Borough of Palmyra 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 61.0 kBtu/ft2yr compared to the national average of (Other/Fire Station) space type buildings consuming an average of 78.0 kBtu/$ft^2$yr. Implementing this report's recommendations will reduce use approximately 27.9 kBtu/ft2yr. Due to the nature of its calculation that is based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. The Firehouse annual natural gas costs are competitive and the electric costs are $2,193 higher when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the 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

- Install NEMA premium motors when replacements are required
- Replace old heating terminal units - such as perimeter baseboard radiators
- Replace three (3) hot water circulating pumps
- Replace toilet exhaust fans and ductwork and sidewall kitchen fan
- Replace emergency generator with more modern model
- At the next major renovation add insulation to ineffectively or under-insulated exterior wall

**Category II Recommendations: Operations and Maintenance**

- Maintain roofs
- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing
- Install operable interior shading devices on windows
- Slope perimeter grade away from building to maximize site drainage
- Safely and properly bring power to outside electric users per federal, state and local code
- Provide weather stripping/air sealing
- Repair/seal wall cracks and penetrations
- Expand/provide water efficient fixtures and controls
- Boiler room and building piping insulation - Insulate un-insulated heating piping
- Expansion tanks water levels and the integrity of the tank bladders to be checked regularly
- Tighten belts on exhaust fans
- Change filters in furnaces monthly to ensure efficient operation
- Use Energy Star labeled appliances
- Use smart power electric strips - in conjunction with occupancy sensors
- Create an energy educational program for the Maintenance staff

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

At this time, SWA highly recommends a total of **4** Energy Conservation Measures (ECMs) for the Firehouse as summarized in the following Table 1. The total investment cost for these ECMs without incentives is **$4,489**. SWA estimates a first year savings of **$1,140** with a simple payback of **3.7 years**. SWA also recommends **8** more ECMs with a total first year savings of **$22,806** as summarized in Table 2 and **4** more End of Life Cycle ECMs with a total first year savings of **$1,747** as summarized in Table 3. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Firehouse by **90,702 lbs of $CO_2$**, which is equivalent to removing approximately 8 cars from the roads each year or avoiding the need of 221 trees to absorb the annual $CO_2$ generated.

There are various incentives that the Borough of Palmyra could apply for that could also help lower the cost of installing the ECMs, such as enroll in the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive program can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, has been rolled out recently and could also assist to cover up to 60% of the capital investment. SWA also recommends that the Borough of Palmyra investigate the benefits of the Pay for Performance and Energy Efficiency and Conservation Block Grant programs, briefly described in Appendix D Incentive Programs.

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

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 (1) beverage vending machine energy miser | www.usatech.com and established costs | 279 | 0 | 279 | 1,456 | 0.6 | 0 | 0.5 | 0 | 290 | 12 | 3,477 | 1.0 | 1146 | 96 | 104 | 2,491 | 2,607 |
| 2.1 | replace (1) fluorescent Exit sign fixtures with LED Exit sign type | RS Means, Lit Search | 185 | 20 | 165 | 96 | 0.0 | 0 | 0.0 | 18 | 37 | 15 | 549 | 4.5 | 233 | 16 | 21 | 257 | 172 |
| 2.2 | Replace (41) incandescent with CFLs | RS Means, Lit Search | 1,025 | None at this time | 1,025 | 976 | 0.4 | 0 | 0.3 | 105 | 299 | 5 | 1,496 | 3.4 | 46 | 9 | 14 | 327 | 1,748 |
| 3 | Replace boiler rear Rec room with high efficiency condensing boiler | Similar projects | 3,000 | 300 | 2,700 | 0 | 0.0 | 450 | 4.3 | 0 | 514 | 25 | 12,859 | 5.2 | 376 | 15 | 19 | 5,872 | 4,960 |
| | **Totals** | | **4,489** | **320** | **4,169** | **2,528** | **1.0** | **450** | **5.1** | **123** | **1,140** | - | **18,381** | **3.7** | **341** | - | **24** | **8,948** | **9,487** |

**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 |
| 2.3 | Replace Metal Halide fixtures with pulse start MH type | RS Means, Lit Search | 3,250 | 125 | 3,125 | 1,664 | 0.7 | 0 | 0.5 | 240 | 571 | 15 | 8,567 | 5.5 | 174 | 12 | 16 | 3,484 | 2,979 |
| 4.1 | Replace (1) old bar refrigerator with Energy Star model | Energy Star procurement site, similar projects | 750 | 0 | 750 | 350 | 0.1 | 0 | 0 | 50 | 120 | 12 | 1,436 | 6.3 | 91 | 8 | 12 | 414 | 627 |
| 5 | Install 24.8 kW PV with Incentives | Similar Projects | 186,300 | 24,840 | 161,460 | 23,682 | 24.8 | 0 | 7.7 | 0 | 18,933 | 25 | 331,118 | 8.5 | 1 | 0 | 9 | 83,461 | 42,403 |
| 6.1 | Replace 4-ton gas heating / electric cooling split HVAC with high eff 14 SEER | Similar projects | 9,000 | 668 | 8,332 | 3,657 | 1.5 | 105 | 2.2 | 150 | 998 | 15 | 14,966 | 8.4 | 80 | 5 | 8 | 3,303 | 7,705 |
| 6..2 | Replace 3.5-ton gas heating / electric cooling split HVAC systems - with high eff 14 SEER | Similar projects | 7,500 | 622 | 6,878 | 2,400 | 1.0 | 130 | 2.0 | 150 | 776 | 15 | 11,643 | 8.9 | 69 | 5 | 7 | 2,186 | 5,730 |
| 6.3 | Replace 4-ton gas heating / electric cooling split HVAC systems with high eff 14 SEER | Similar projects | 9,000 | 668 | 8,332 | 2,742 | 1.1 | 155 | 2.4 | 150 | 873 | 15 | 13,092 | 9.5 | 57 | 4 | 6 | 1,878 | 6,618 |
| 6.4 | Replace 2.5-ton electric heating/electric cooling split with high eff 14 SEER | Similar projects | 5,500 | 530 | 4,970 | 1,720 | 0.7 | 0 | 0.6 | 150 | 492 | 15 | 7,384 | 10.1 | 49 | 3 | 5 | 797 | 3,080 |
| 7 | Replace (1) 7.5 HP vehicle exhaust fan motor with Premium Efficiency | DOE International Motor Master selection & savings analysis | 556 | 90 | 466 | 220 | 0.1 | 0 | 0.1 | 0 | 44 | 20 | 876 | 10.6 | 88 | 4 | 7 | 168 | 394 |
| | **Totals** | | **221,856** | **27,543** | **194,313** | **36,435** | **30.0** | **390** | **15.6** | **890** | **22,806** | **-** | **389,082** | **8.5** | **100** | **-** | **9** | **95,691** | **69,536** |

| 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 |
| 4.2 | Replace one (1) old kitchen icemaker with an Energy Star model | Energy Star purchasing and procurement site, similar projects | 2,800 | 0 | 2,800 | 800 | 0.3 | 0 | 0.3 | 50 | 209 | 12 | 2,510 | 13.4 | -10 | -1 | -2 | -719 | 1,432 |
| 8 | Replace boilers main basement with high efficiency condensing boilers | Similar projects | 15,000 | 1,225 | 13,775 | 0 | 0.0 | 565 | 5.4 | 0 | 646 | 25 | 16,145 | 21.3 | 17 | 1 | 1 | -2,690 | 6,228 |
| 2.4 | Replace (91) T12 fixtures throughout the bldg with new T8 fixtures | Replace (91) T12 fixtures throughout the bldg with new T8 fixtures | 19,565 | 2,275 | 17,290 | 1,555 | 0.6 | 0 | 0.5 | 455 | 764 | 15 | 11,467 | 22.6 | -34 | -2 | -5 | -8,038 | 2,784 |
| 9 | Replace (2) gas DHW heaters with Energy Star natural gas condensing type models | Energy Star purchasing and procurement site, similar projects | 4,550 | 100 | 4,450 | 0 | 0.0 | 112 | 1 | 0 | 128 | 12 | 1,536 | 34.8 | -65 | -5 | -13 | -3,092 | 1,235 |
| | **Totals** | | **41,915** | **3,600** | **38,315** | **2,355** | **1.0** | **677** | **7.2** | **505** | **1,747** | **-** | **31,658** | **21.0** | **-17** | **-** | **-2** | **-14,539** | **11,679** |

## 1. HISTORIC ENERGY CONSUMPTION

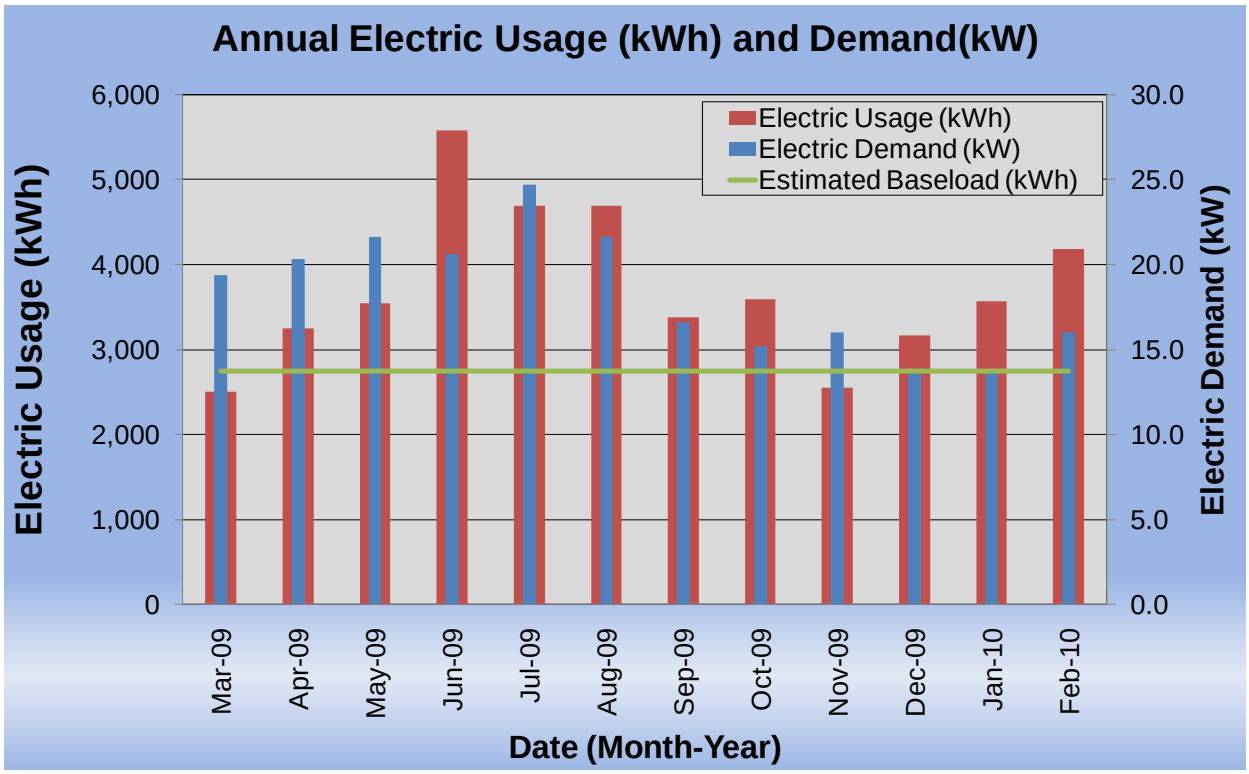
### 1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from April 2007 through March 2009 that were received from the utility companies supplying the Palmyra Firehouse with electric and natural gas.

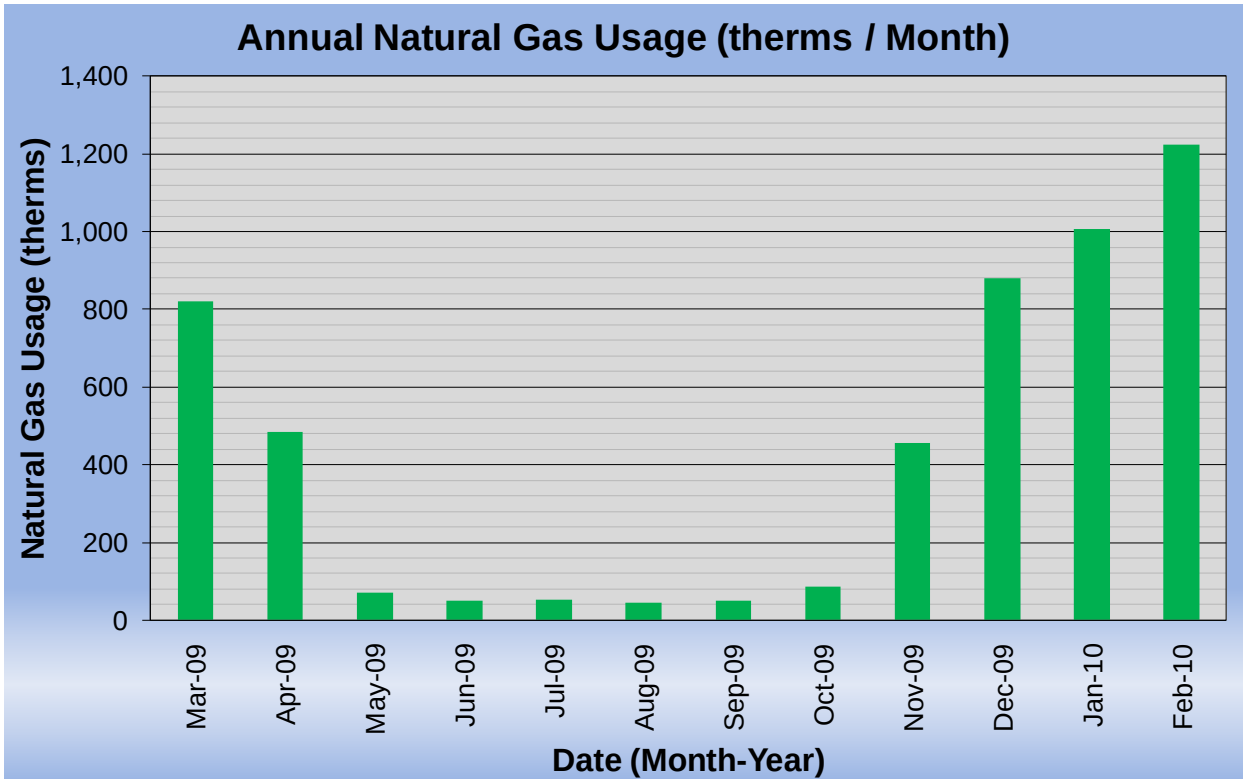
Electricity - The Palmyra Firehouse is currently served by four electric meters. The Firehouse currently buys electricity from PSE&G at **an average rate of $0.199/kWh** based on 12 months of utility estimates from March 2009 through February 2010. The Firehouse purchased **approximately 44,729 kWh or $8,902 worth of electricity** in the previous year. The average monthly demand was 18 kW, peaking at 25 kW during the analyzed period.

Natural gas - The Palmyra Firehouse is currently served by one meter for natural gas. The Palmyra Firehouse currently buys natural gas from PSE&G at **an average aggregated rate of $1.143/therm** based on 12 months of utility bills for March 2009 through February 2010. The Palmyra Firehouse purchased **approximately 5,228 therms or $5,974 worth of natural gas** in the previous year at a very competitive rate.

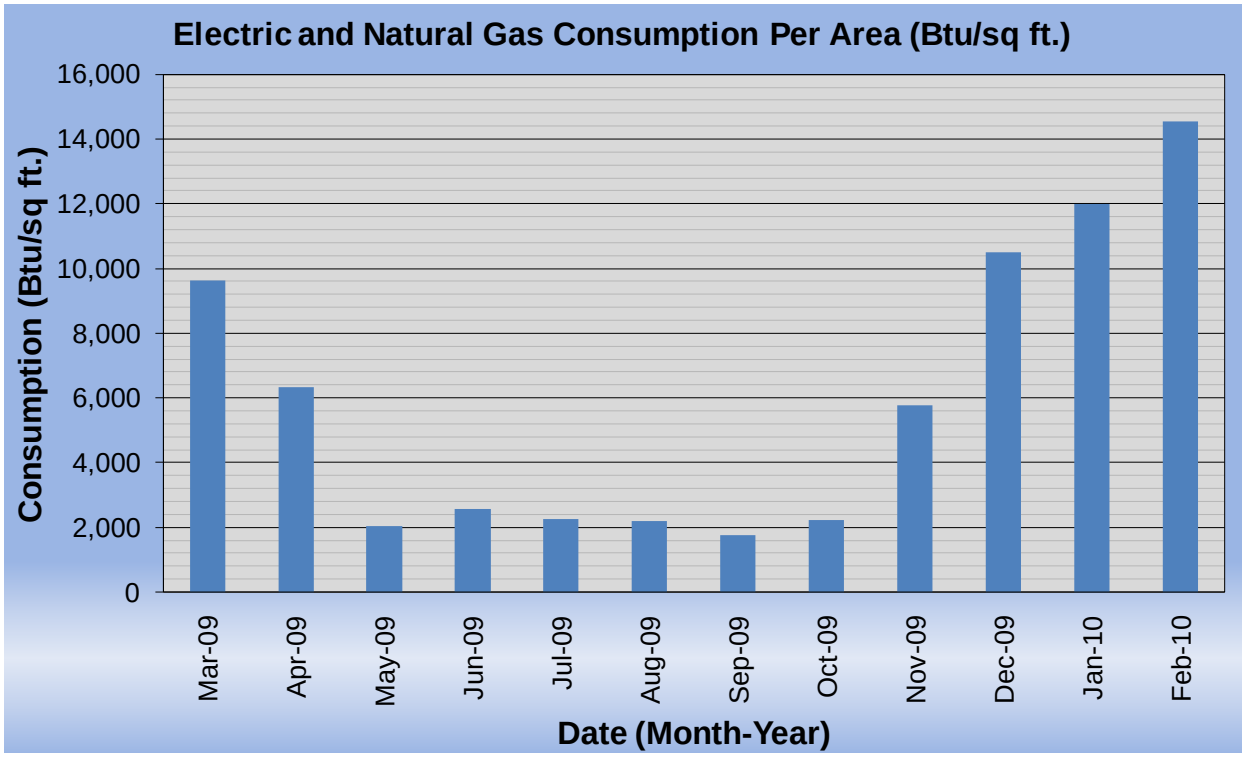
The following chart shows electricity consumption for the Firehouse based on electric bills for the 12 month period of March 2009 through February 2010. It is assumed that furnace blowers are operating summer and winter to circulate the conditioned air.




The following chart shows the natural gas consumption for the Firehouse based on natural gas bills for the 12 month period of March 2009 through February 2010.

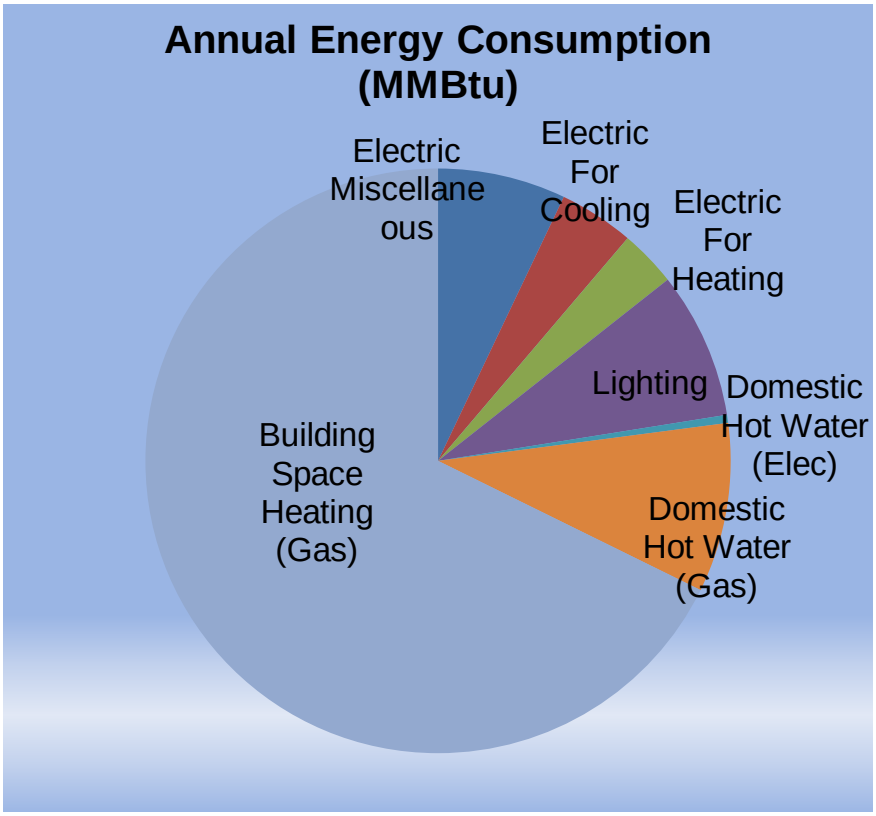


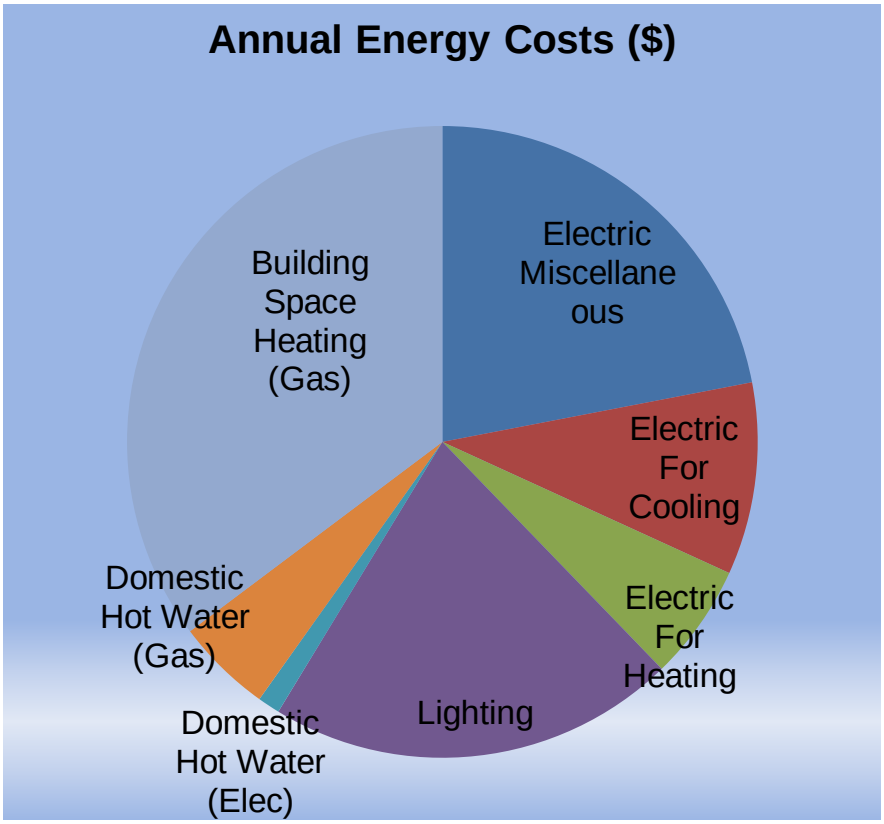

The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Firehouse based on estimates and utility bills for the 12 month period of March 2009 through February 2010.



The following table and pie charts show energy use for the Firehouse based on utility bills for the 12 month period of March 2009 through February 2010. Note electrical cost at $58/MMBtu of energy is more than 5 times as expensive to use as natural gas at $11/MMBtu. Air Handling Unit (AHU) blower and heat pump usage is included in the electric miscellaneous usage below.

| 2009 Annual Energy Consumption/Costs | | | | | |
|---|---|---|---|---|---|
| | **MMBtu** | **% MMBtu** | **$** | **% $** | **$/MMBtu** |
| **Electric Miscellaneous** | 56 | 8% | $3,269 | 22% | 58 |
| **Electric For Cooling** | 25 | 4% | $1,466 | 10% | 58 |
| **Electric For Heating** | 15 | 2% | $884 | 6% | 58 |
| **Lighting** | 53 | 8% | $3,113 | 21% | 58 |
| **Domestic Hot Water (Elec)** | 3 | 0% | $170 | 1% | 58 |
| **Domestic Hot Water (Gas)** | 64 | 9% | $731 | 5% | 11 |
| **Building Space Heating (Gas)** | 459 | 68% | $5,243 | 35% | 11 |
| **Totals** | 675 | 100% | $14,876 | 100% | 22 |
| | | | | | |
| **Total Electric Usage** | 153 | 23% | $8,902 | 60% | 58 |
| **Total Gas Usage** | 523 | 77% | $5,974 | 40% | 11 |
| **Totals** | 675 | 100% | $14,876 | 100% | 22 |






### 1.2. Utility Rate

The Firehouse currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Firehouse currently pays an average rate of approximately $0.199/kWh based on the 12 months estimates of March 2009 through February 2010.

The Firehouse currently purchases natural gas from the 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 Firehouse currently. The average aggregated rate (supply and transport) for the meter is approximately $1.143/therm based on 12 months of utility bills for March 2009 through February 2010.

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 Firehouse in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is a Fire Station and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Borough of Palmyra 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 61.0 kBtu/ft2yr compared to the national average of (Other/Fire Station) space type buildings consuming an average of 78.0 kBtu/ft$^2$yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 5.1 kBtu/sq ft yr, with an additional 15.6 kBtu/sq ft yr from the recommended ECMs, and 7.2 kBtu/sq ft yr from the End of Life Cycle recommended ECM. Implementing this report's recommendations will reduce use approximately 27.9 kBtu/ft2yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance.

Per the LGEA program requirements, SWA has assisted the Borough of Palmyra to create an *Energy Star Portfolio Manager* account and share the 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 Palmyra (user name of "boropalmyra" with a password of "palmyraboro") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

# STATEMENT OF ENERGY PERFORMANCE
# Borough of Palmyra - Independent Fire Company #1

**Building ID:** 2043681
**For 12-month Period Ending:** February 28, 2010[1]
**Date SEP becomes ineligible:** N/A
**Date SEP Generated:** April 02, 2010

**Facility**
Borough of Palmyra - Independent Fire Company #1
115 West Broad Street
Palmyra, NJ 08065

**Facility Owner**
N/A

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

**Year Built:** 1900
**Gross Floor Area (ft²):** 10,500

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

| **Site Energy Use Summary**[3] | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 148,997 |
| Natural Gas (kBtu)[4] | 489,007 |
| Total Energy (kBtu) | 638,004 |

| **Energy Intensity**[5] | |
|---|---|
| Site (kBtu/ft²/yr) | 61 |
| Source (kBtu/ft²/yr) | 96 |

| **Emissions** (based on site energy use) | |
|---|---|
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 49 |

**Electric Distribution Utility**
Public Service Elec & Gas Co

| **National Average Comparison** | |
|---|---|
| National Average Site EUI | 78 |
| National Average Source EUI | 157 |
| % Difference from National Average Source EUI | -39% |
| 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 (including a partial basement), 10,500 square feet Palmyra Firehouse was originally constructed in the early 1900s with additions/alterations performed in 1956, 1990 and 1995. It houses on the first floor: storage rooms, locker rooms, bathrooms, a Ready room with bar, a Ladies meeting room and kitchenette, a commercial kitchen, truck bays for 3 gas fire engines, 4 diesel fire engines and 2 gas boats. The front second floor houses a meeting room, the Chief's office, the Secretary's office, the President's office, an uniform locker room, a bathroom and display cases. The back second floor houses a recreation room, a furnace room and a bathroom. The boiler room is in the partial basement located under the ladder truck bay. The building was built for a car dealership. It then was taken over and served as an A&P supermarket until the Borough of Palmyra bought the property in 1956 and renovated the building into a firehouse. There are 14 double size garages at the rear of the firehouse that are rented out as storage space.

Front Façade

Left Side Façade

Right Side Façade


Rear Façade

### 2.2. Building Occupancy Profiles

Occupancy for the Palmyra Firehouse building is approximately 3-5 volunteers (of a total of 40) for 20 hours a week. There is usually one special recreational event held every couple of months for the volunteer fire department members. The Independence Fire Company No. 1 has approximately 300 annual call-outs.

## 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 analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

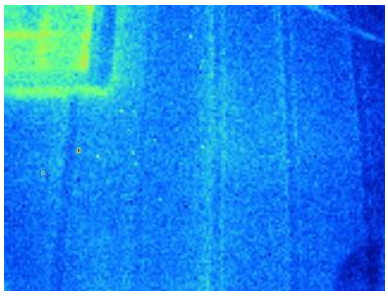
### 2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of stucco and some brick veneer accents over 5-1/2" wood stud framing with an unconfirmed level of fiberglass batt cavity insulation. Other areas are constructed of vertical aluminum panel system and some vinyl siding over 5-1/2" wood stud framing with an unconfirmed level of fiberglass batt cavity insulation. The interior is mostly painted and tiled gypsum wallboard.

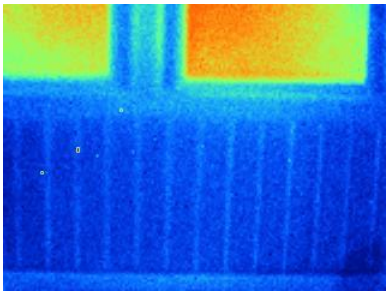
*Note:* Wall insulation levels could not be verified in the field and are based on reports from building management/maintenance personnel.

During the field audit exterior and interior wall surfaces were inspected. They were found/reported to be in overall acceptable/age appropriate condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues detected on all facades.

The following specific exterior wall problem spots and areas were identified with IR images to further visualize some of the exterior wall issues:



Insufficiently insulated siding - left side



Insufficiently insulated siding - right side

Cracked or deteriorating stucco showing signs of water/moisture

Deteriorating exterior wall finish in need of brick re-pointing

Interaction between electrical cable and exterior wall finish could lead to an unsafe situation

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Replace broken/ deteriorated bricks and re-point cracked mortar joints.

2. Add insulation to ineffectively or under-insulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and cover with gypsum wallboard or other preferred interior finish with the next major renovation.

3. Safely and properly bring power to outside electric users per federal, state and local code.

4. Inspect and replace cracked/ineffective stucco.

### 2.3.2 Roof

The building's front roof is predominantly a medium-pitch gable type over a wood structure with an asphalt shingle finish. It was replaced approximately 20 years ago. 3 inches of fiberglass batt attic/ceiling and no detectable/assumed roof insulation were recorded. The middle section of the building is covered by a flat and parapet type over wood decking with a built-up asphalt finish and gravel ballast and 3 inches of fiberglass batt attic/ceiling and no detectable/assumed roof insulation. The back section is pitched and covered with asphalt shingles, similar to the front part of the building. These roofs should be scheduled to be replaced in 5-10 years.

Note: Roof insulation levels could not all be verified in the field and are based on reports from building management/maintenance personnel.

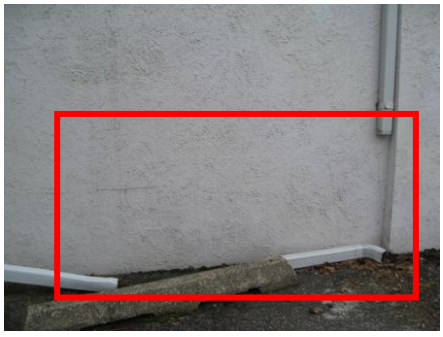
During the field audit roofs, related flashing, gutters and downspouts were inspected. They were found/reported to be in overall satisfactorily/age appropriate condition with some signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues on some roof areas.

The following specific roof problem spots and areas were identified:

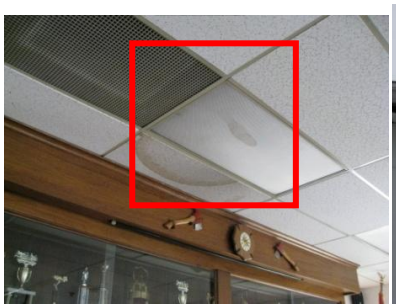
Water pooling on side of the flat roof

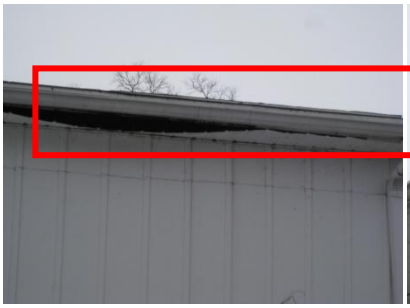
Water pooling on side of the flat roof

Old backside asphalt shingle roof



Disconnected/fallen gutters; missing splash blocks; rain water needs to flow away from the building via a splash block or equivalent





Leaking roof needs repairs/patching; soffit siding has come loose in a few areas and needs fixing

In light of the roof conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Unclog and maintain all roof drains/scuppers.

2. Clean gutters and downspouts. Reconnect them properly and ensure flow is over splash blocks away from the building.

3. Repair/replace roof finish due to age and condition with the next major renovation.

### 2.3.3 Base

The building's base is composed of a slab-on-grade floor with a perimeter foundation 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 and 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 neither visible on the interior nor exterior.

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Slope perimeter grade away from building to maximize site drainage.

### 2.3.4 Windows

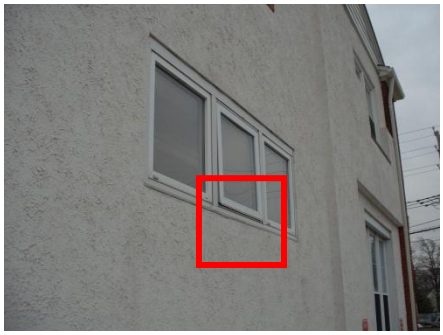
The building contains basically two different types of windows.

1. Left side of the building has a number of awning type windows with vinyl frames, low-E/gas filled double glazing and no interior or exterior shading devices. The windows are located on the south facade and were replaced a few years ago.

2. The balance of the building has double-hung type windows with vinyl frames, low-E/gas filled double glazing and no interior or exterior shading devices. The windows are located throughout the building and were replaced a few years ago.

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/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific window concern areas were identified:



A number of awning type windows cannot be close tightly and allow loss of conditioned air

Shades are recommended to control UV light, overheating during summer and cooling during winter

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Install operable interior shading devices on windows.

2. Install/replace/maintain sealants at all windows for airtight performance.

### 2.3.5 Exterior Doors

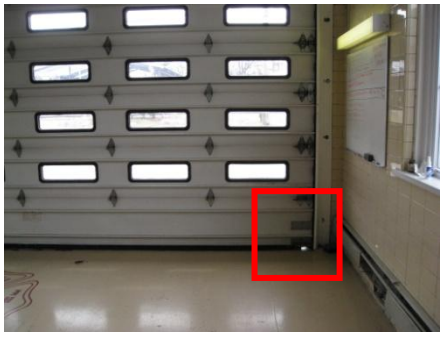
The building contains several different types of exterior doors.

1. A number of overhead type exterior doors. They are located in the front and rear of the building and were replaced approximately 15 years ago.

2. A number of hollow metal with vision panel type exterior doors. They are located in the front and rear of the building.

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/age appropriate 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

Missing/worn weather stripping

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further 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 earlier in this chapter.

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 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.

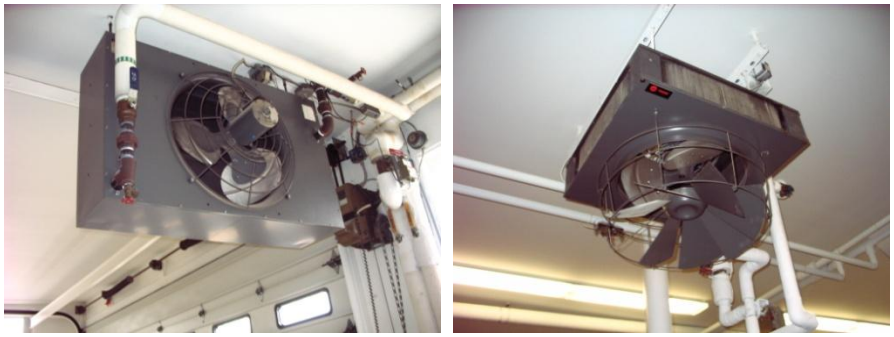
## 2.4 HVAC Systems

### 2.4.1 Heating

The building is heated by a series of boilers and furnaces. The office areas, meeting space, Recreation room, bar and gym area are also cooled via multiple split systems. The front portion of the building is heated by two (2) Weil-McLain gas-fired boilers that are located in the partial basement below the garage. Each identical boiler was installed in 1993 and provides 301 MBH of output. These boilers have an estimated remaining life of 40%. Each boiler is installed with its own supply pump. The heating system appears to be arranged such that there is one primary boiler and pump, and one backup pair.

Gas-fired Boilers in Basement Mechanical Room

Hot water is supplied to two (2) horizontal hydronic unit heaters near the front garage doors, two (2) vertical hydronic unit heaters located at the underside of the second floor and behind the central stair, baseboard finned-tube radiation in the garage and hydronic unit heater in the Kitchen and downstairs bar. Heating is controlled by wall-mounted thermostats in each zone. It should be noted that the vertical unit heaters are not provided with OSHA fan guards. This could be a hazardous situation since there is some high storage below the units and they are accessible to the occupants of the facility.



Unit heaters in garage

Heating for the second floor meeting room above the garage is provided by a gas-fired furnace with DX cooling coil located in a closet at the rear of this level. The furnace is ducted to above the ceiling, where it feeds ceiling diffusers in the meeting room and adjacent offices on this level. This unit was installed in 1987 and is beyond its expected useful life of 18 years, according to the 2007 ASHRAE Applications Handbook.

Heating for the small gym, offices and kitchen at the rear of the garage is provided by a gas-fired furnace with DX cooling coil located in the small gym. This furnace is ducted to above the ceiling, where it is ducted to registers in the spaces that it serves. This unit was installed in 1968 and is well beyond its expected useful life of 18 years, according to the 2007 ASHRAE Applications Handbook**.**

Domestic Water Heater and Furnace in Small Gym

Heating for the second floor recreation room is provided by a Weil-McLain gas-fired boiler located in a closet at the rear of the recreation room. The boiler was installed in approximately 1974 and provides 84 MBH of output. This boiler is beyond it expected useful life of 30 years, according to the 2007 ASHRAE Applications Handbook. This boiler has one supply pump that appears to be the same age as the boiler. The boiler serves an air handler heating coil that is located in the same closet, and fined-tube baseboard radiation located in the recreation room.

Heating for the bar is provided by an electric furnace located in a closet adjacent to the bar. This furnace is ducted above the ceiling of the bar to ceiling diffusers in the bar. This unit was installed in 1987 and is beyond its expected useful life of 18 years, according to the 2007 ASHRAE Applications Handbook**.**

### 2.4.2 Cooling

The second floor meeting room and offices in the front portion of the building, the first floor gym, kitchen and offices and bar and the second floor recreation room are all provided with cooling. The garage is not cooled.

The second floor meeting room and offices are cooled via a DX split system with a furnace mentioned above, and a condensing unit on the flat roof outside the furnace closet. This system is over 20 years old (circa 1986) and is beyond its expected life span. The first floor gym, kitchen and offices are cooled by a DX split system with furnace located in the small gym and condensing unit located on the flat roof. The condensing unit is circa 1986 and is beyond its expected life span.

The second floor recreation room is cooled by a DX split system with air handling unit in the rear closet next to the boiler. The condensing unit for this system is located on grade behind the building. This unit was installed in 1974 and is well beyond it expected life of 15 years. The bar is cooled by a DX split system with electric furnace located in the closet beside the bar. The condensing unit for this system is located on grade behind the building. This unit was installed 1987 and is beyond its expected life span

The cold air is distributed throughout all mentioned conditioned spaces by ductwork and diffusers. Cooling is controlled by a wall mounted thermostat in each space.

Split System Condensing Units on Grade for Bar and Second Floor Recreation Room

### 2.4.3 Ventilation

There does not appear to be any mechanical ventilation for occupancy being provided to the facility. Further study should be undertaken to determine if this condition is code compliant via natural ventilation, but this study is outside the scope of this report.

The garage area is ventilated via a vehicle exhaust fan. The vehicle exhaust fan had no indication of age on its nameplate, but it is estimated to be about 10 years old. This fan is expected to have 5-10 years of remaining life. The kitchen also has a sidewall exhaust fan with fan guard, and appears to be very old and beyond its expected lifespan.

There are two toilet rooms have toilet exhaust systems that are beyond their operating lives. The Borough should install new exhaust fans and ductwork as part of a capital improvement project.

Vehicle Exhaust Fan on Roof (left) and Vehicle Exhaust Connection to Truck

### 2.4.4 Domestic Hot Water

There are three (3) domestic water heaters in the building. The partial basement contains one (1) 40 gallon gas-fired heater that was installed in 1997. This heater is believed to serve the toilet rooms near the rear of the garage. This equipment is at the end of its expected lifespan. The gym contains one (1) 40 gallon gas-fired heater that was installed in 2001. This heater serves the kitchen and is about halfway through its expected life. The mechanical closet adjacent to the bar contains a small 12 gallon electric tank type water heater to serve the bar sink. The age of this unit could not be determined from the nameplate, but it is assumed to be the same age as the electric furnace, which was installed in 1987. That would put this unit beyond its expected service life.

Domestic Water Heater in Basement Mechanical Room (on right in left photo) and in Gym

### Commercial Refrigeration

There is (1) refrigerator in the kitchen that has no indication of age on the nameplate but is estimated to be greater than 10 years old. This unit is not Energy Star rated. There is one (1) commercial stainless steel 2-door refrigerator in the kitchen. There was no visible nameplate, but based on condition and the fact that it utilizes R-134a refrigerant, it is estimated to be about 5 years old. The kitchen also contains a commercial ice machine. This unit was manufactured in 1995 and is in fair condition. The bar contains a commercial refrigerator in the mechanical closet. There was no visible nameplate, but based on the fact that the unit uses R-12 refrigerant, it is estimated to be from the 1990s or before. This unit should be replaced with a more energy efficient model that utilizes environmentally friendly refrigerant.

Commercial Refrigerator (left) and Ice Machine in Kitchen

## 2.5 Electrical Systems

### 2.5.1 Lighting

*Interior Lighting* - The interior lighting of the Firehouse consists of T12 fixtures with magnetic ballasts, T8 fixtures with electronic ballasts and a few CFL and incandescent bulbs. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing T12 with T8 fixtures and incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. See the 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 fluorescent type. SWA recommends replacing fluorescent with LED type Exit signs.

*Exterior Lighting* - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures and one CFL fixture. Exterior lighting is controlled mainly by timers. SWA recommends replacing MH fixtures of high wattage with pulse-start MH lamps which offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior light photocells.

### 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 Beverage 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. See section 4, Energy Conservation Measures for details on replacing refrigerators and installing energy misers on vending machines.

Computers left on inside 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 often have internal memories or clocks which consume approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances, (other than refrigerators and freezers), be plugged into power strips and turned off each evening just as the lights are turned off. The building's 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 Palmyra Firehouse does not have an installed elevator.

### 2.5.4 Other Electrical Systems

Besides an emergency 15 kW Onan-Cummins generator used for emergency back-up, which is operating beyond its expected useful life, and a few small transformers in satisfactory condition, there are not currently any other significant energy impacting electrical systems installed at the Firehouse.

## 3. EQUIPMENT LIST

### Inventory

| Building System | Description | Location | Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating/ Cooling | Natural Gas Furnace Est. 60% Efficiency | Gym/Hose Room | Williamson Temp-O-Matic Model # 1117-10-3 100 MBH input, 80 MBH Output Serial #6805498 | Natural Gas | Kitchen/Gym Area | 1968 | 0% |
| Heating/ Cooling | Natural Gas Furnace Est. 65% Efficiency | 2nd Floor, Front Bldg | Bryant Model # 395BAW048120 | Natural Gas | 2nd Floor Front Building | 1987 | 0% |
| Heating/ Cooling | Electric Furnace Est. 90+% Efficiency | Main Floor Bar | Bryant Model # 517EN030 (1) 30A circuit; (1) 40A circuit Serial # 3687A13374 | Electric | Bar | 1987 | 0% |
| Heating/ Cooling | Natural Gas Furnace Est. 60% Efficiency | 2nd Floor, Rear Bldg | Rheem Model # MB1400 Serial # F387433190 | Natural Gas | Rear Addition | 1974 | 0% |
| Heating | 2 Boilers Est. 70% Efficiency | Basement | Weil-McLain Model # PFG-8-PIN Series 5 427 MBH Input; 301 MBH Output | Natural Gas | Front Portion | 1993 | 40% |
| Heating | 2 Pumps Est. 75% Efficiency | Basement | Bell & Gossett Model # M80067 1/2 HP Bell & Gossett Model # BQA56A17058EP 1/2 HP | Electric | Front Portion | 1993 | 0% |
| Heating | Boiler Est. 60% Efficiency | Upstairs Rec Room | Weil McLain PCG-4 105 MBH Input; 84 MBH Output | Natural Gas | Rear Addition | 1974 | 0% |
| Heating | Hot Water Supply Pump Est. 75% Efficiency | Upstairs Rec Room | Taco Model # 5XB0013 1/12 HP | Electric | Rear Addition | 1974 | 0% |
| Heating | 2 Hydronic Unit Heaters – Horizontal Est. 80% Efficiency | Garage | Trane Model # UHSA-354S-8C-AAN Serial # D92A00173 | Electric | Garage, Front Doors | 1993 | 10-20% |
| Heating | 2 Hydronic Unit Heaters - Vertical Est. 80% Efficiency | Garage | Nameplate Not Legible, Similar to Trane Model # UHPA Series | Electric | Garage, Behind Central Stair | 1993 | 10-20% |
| continued on the next page | | | | | | | |

| Building System | Description | Location | Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| continued from the previous page | | | | | | | |
| Heating | Hydronic Unit Heater Est. 75% Efficiency | Kitchen | No Nameplate | Electric | Kitchen | 1993 | 10-20% |
| Cooling | Air Cooled Condensing Unit Est. 7.0 SEER | Roof | Bryant Model # 56EJ048 Serial # 4086C32941 | Electric | 2nd Floor Above Garage | 1986 | 0% |
| Cooling | Air Cooled Condensing Unit Est. 7.0 SEER | Roof | Bryant Model # 568EJX042000AGAA Serial # 3937E49111 | Electric | Kitchen/Gym Area | 1986 | 0% |
| Cooling | Air Cooled Condensing Unit Est. 7.0 SEER | Exterior Rear of Building on Grade | Bryant Model # 568EJ030 Serial # 4186C41496 | Electric | Bar | 1987 | 0% |
| Cooling | Air Cooled Condensing Unit Est. 6.0 SEER | Exterior Rear of Building on Grade | Rheem No Nameplate, Poor Condition Approx. 4 ton | Electric | Rear Addition | 1974 | 0% |
| Domestic Hot Water | Domestic Water Heater - Est. 75% Efficiency | Basement | Bradford White Model # M-I-40T6FBN 40 Gallon, 40 MBH Input Serial # DJ9610773 | Natural Gas | Front Portion | 1997 | 0% |
| Domestic Hot Water | Domestic Water Heater - Est. 80% Efficiency | Gym/Hose Room | Bradford White Model # M-I-40T6EN12 40 Gallon, 40 MBH Input Serial # XB3457915-131-77 | Natural Gas | Kitchen | 2001 | 40% |
| Domestic Hot Water | Domestic Water Heater - Est. 95+% Efficiency | Main Floor Bar | Bradford White Model # M-I-12UTSSS13 12 Gallon | Electric | Bar | 2001 | 40% |
| Ventila-tion | Vehicle Exhaust Fan - Est. 80% Efficiency | Roof | American Fan Company Model # M361-7.5 7.5HP | Electric | Front Garage | circa 2000 | 50% |
| Refrigera tion | Commercial Refrigerator | Kitchen | No Nameplate Visible | Electric | Kitchen | Est. 2005 | 50% |
| Refrigera tion | Smaller Freezer | Kitchen | United, No Model Number Visible | Electric | Kitchen | Est 1990s | 0% |
| Refrigera tion | Refrigerator | Kitchen | Magic Chef | Electric | Kitchen | Late 1990s | 0-10% |
| continued on the next page | | | | | | | |

| Building System | Description | Location | Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| continued from the previous page | | | | | | | |
| Refrigeration | Refrigerator | Main Floor Bar | Reed Industries<br>Model # V43OXD<br>R-12<br>Serial # VM10176 | Electric | Bar | 1990s | 0% |
| Refrigeration | Ice Machine | Kitchen | Manitowac Model #BD0152A<br>Serial # 950162085 | Electric | Kitchen | 1995 | 0% |
| Genera-tor | Diesel Generator with External Tank | Rear Storage Garage | Onan-Cummins<br>Model # 15:ORDJC-18RC/1567AA<br>15 KW<br>Serial # K760181596 | Diesel | Building Emergency Lights & Overhead Doors | 1976 | 0% |
| Lighting | See details - Appendix A | See details - Appendix A | See details - Appendix A | Electric | Firehouse | Varies | On the average 20% |

**Note:** The remaining useful life of a system (in %) is an estimate based on the system's manufacturing date and existing conditions derived from visual inspections

## 4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Palmyra 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**

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives, such as those associated with the AC units or pumps.

- Replace heating terminal units - such as perimeter baseboard radiators in the garage and finished areas and hydronic unit heaters in the garage and kitchen. This equipment is in fair condition and approaching the end of its expected service life. 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 to improve the overall efficiency of the heating system. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace three (3) hot water circulating pumps - Three (3) hot water circulating pumps are operating beyond their expected service lives. These pumps should be replaced with pumps containing NEMA premium efficiency motors. Since the pumps are fractional horsepower, this measure would yield minimal energy savings and does not qualify for NJ Clean Energy incentives, and so it was not included as an ECM. The estimated cost for this measure is $3,000 and the simple payback is approximately 40 years.

- Replace toilet exhaust fans and ductwork and sidewall kitchen fan - This equipment is run by fractional horsepower motors and the run hours are not significant, so the replacements cannot be justified by energy savings alone and there are no NJ Clean Energy rebates available. However, due to the age and condition of the equipment, replacement is recommended. The estimated replacement cost for this measure is $1,000.

- Replace emergency generator with more modern model to serve boilers, pumps and HVAC systems as well as emergency lighting to provide freeze protection in the event of an extended power outage during the winter months. The estimated installation cost is $15,000.

- At the next major renovation add insulation to ineffectively or under-insulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and cover with gypsum wallboard or other preferred interior finish with the next major renovation.

**Category II Recommendations: Operations and Maintenance**

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Add insulation to ineffectively and under-insulated roof/ceiling sections. SWA recommends properly maintaining exterior roof insulation in an effort to minimize energy loss. Unclog and maintain all roof drains/scuppers. Repair/replace roof finish due to age and condition with the next major renovation.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage. Clean gutters and downspouts. Reconnect them properly and ensure flow is over splash blocks away from the building.

- Install operable interior shading devices on windows.

- Slope perimeter grade away from building to maximize site drainage.

- Safely and properly bring power to outside electric users per federal, state and local code.

- Provide weather stripping/air sealing - 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. 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. Inspect and replace cracked/damaged stucco. The perimeter of all window frames should be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames. Replace broken/ deteriorated bricks and re-point cracked mortar joints.

- Expand/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. Maintenance 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.

- Boiler room and building piping insulation - Insulate un-insulated heating piping in the Recreation room mechanical closet and throughout the building to efficiently deliver heat where required and provide personnel protection.

- Water levels in the expansion tanks and the integrity of the tank bladders should be checked to confirm proper operation.

- Tighten belts on exhaust fans - Tightening belts on belt-driven exhaust fans such as the vehicle exhaust fan can maximize overall efficiency of the equipment.

- Change filters in furnaces monthly to ensure efficient operation of the fan, ensure adequate air delivery to the space and avoid overheating of the furnace’s heat exchanger, which can cause cracking and require replacement.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment. Review use of kitchen refrigeration equipment and replace with new higher efficiency units depending on how often they are used.

- 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 for the Maintenance staff - 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 beverage vending machine energy miser |
| 2.1 & 2.2 | Replace florescent Exit sign fixtures with LED Exit sign type and incandescent with CFLs |
| 3 | Replace boiler rear Recreation room with high efficiency condensing boiler |
| | Description of Recommended 5-10 Year Payback ECMs |
| 2.3 | Replace exterior Metal Halide fixtures with pulse start MH type |
| 4.1 | Replace old bar refrigerator with an Energy Star model |
| 5 | Install 24.8 kW PV system |
| 6.1, 6.2, 6.3 & 6.4 | Replace gas heating/electric cooling split HVAC systems with high efficiency systems |
| 7 | Replace 7.5 HP vehicle exhaust fan motor with Premium Efficiency |
| | Description of Recommended End of Life Cycle ECMs |
| 4.2 | Replace old kitchen ice maker with an Energy Star model |
| 8 | Replace boilers main basement with high efficiency condensing boilers |
| 2.4 | Replace T12 fixtures throughout the bldg with new T8 fixtures |
| 9 | Replace gas DHW heaters with Energy Star natural gas condensing type models |

## ECM#1: Install beverage vending machine energy miser

**Description:**

The Firehouse has one beverage vending machine serving the building occupants and visitors. 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.

Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack 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: $279 (includes $100 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 (1) beverage vending machine energy miser | www.usatech.com and established costs | 279 | 0 | 279 | 1,456 | 0.6 | 0 | 0.5 | 0 | 290 | 12 | 3,477 | 1.0 | 1146 | 96 | 104 | 2,491 | 2,607 |

**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.*

**Options for funding ECM:**

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

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

## ECM#2: Building Lighting Upgrades

### Description:

On the day of the site visit, SWA completed a lighting inventory of the Firehouse (see Appendix A). The interior lighting of the Firehouse consists of T12 fixtures with magnetic ballasts, T8 fixtures with electronic ballasts and a few CFL and incandescent bulbs. SWA recommends replacing T12 with T8 fixtures and incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. Exit signs were found to be fluorescent type. SWA recommends replacing fluorescent with LED type Exit signs. The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures and one CFL fixture. SWA recommends replacing MH fixtures of high wattage with pulse-start MH lamps which offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. See the 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 Palmyra 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.

### Installation cost:

Estimated installed cost: $22,015 (includes $15,824 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 (1) florescent Exit sign fixtures with LED Exit sign type | RS Means, Lit Search | 185 | 20 | 165 | 96 | 0.0 | 0 | 0.0 | 18 | 37 | 15 | 549 | 4.5 | 233 | 16 | 21 | 257 | 172 |
| 2.2 | Replace (41) incandescent with CFLs | RS Means, Lit Search | 1,025 | None at this time | 1,025 | 976 | 0.4 | 0 | 0.3 | 105 | 299 | 5 | 1,496 | 3.4 | 46 | 9 | 14 | 327 | 1,748 |
| 2.3 | Replace (5) exterior Metal Halide fixtures with pulse start MH type | RS Means, Lit Search | 3,250 | 125 | 3,125 | 1,664 | 0.7 | 0 | 0.5 | 240 | 571 | 15 | 8,567 | 5.5 | 174 | 12 | 16 | 3,484 | 2,979 |
| 2.4 | Replace (250) T12 fixtures throughout the bldg with new T8 fixtures | RS Means, Lit Search | 19,565 | 2,275 | 17,290 | 1,555 | 0.6 | 0 | 0.5 | 455 | 764 | 15 | 11,467 | 22.6 | -34 | -2 | -5 | -8,038 | 2,784 |
| | **Totals** | | **24,025** | **2,420** | **21,605** | **4,291** | **1.8** | **0** | **1.4** | **818** | **1,671** | **-** | **22,079** | **12.9** | **2** | **-** | **0** | **-3,969** | **7,683** |

**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 19.5 hrs/yr to replace aging burnt out lamps vs. newly installed.

**Rebates/financial incentives:**

- *NJ Clean Energy - LED Exit Signs ($20 per fixture) - Maximum incentive amount is $20.*
- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $125.*
- *NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps) Maximum incentive amount is $2,275.*

**Options for funding the Lighting ECM:** *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.* [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings](http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings)

## ECM#3 Replace boiler rear Recreation room with high efficiency condensing boiler

**Description:**

The existing boiler in the Recreation room is at the end of its useful life and is relatively inefficient as compared to modern condensing boilers. This boiler should be replaced to achieve energy savings. The initial efficiency of the existing boiler is approximately 75%, but it can be assumed that in the time since its installation, it has degraded to an efficiency of about 60%. An upgrade to a condensing boiler of minimum 85% combustion efficiency can be justified by energy savings, and replacement should be considered along with upgrades to other portions of the heating system.

The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% at the worst case boiler operating conditions, such as mid-fire or high-fire conditions with a return water temperature in the range of 140-160 degrees Fahrenheit, and efficiencies of up to 95% achievable with lower return water temperatures. The boiler should be Low NOx certified with a 5:1 turndown burner, PVC direct venting and direct exhaust, hydronic safety controls and interface systems. The boiler shall have compact design for easy retrofit installation, with sectional aluminum block, ASME relief valve, stainless steel burner as a minimum. The air blower should be variable speed combustion with easily removable access panels.

**Installation cost:**

Estimated installed cost: $2,700 (includes $810 of labor)
Source of cost estimate: Manufacturer's data and similar projects

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Replace boiler rear Rec room with high efficiency condensing boiler | Similar projects | 3,000 | 300 | 2,700 | 0 | 0.0 | 450 | 4.3 | 0 | 514 | 25 | 12,859 | 5.2 | 376 | 15 | 19 | 5,872 | 4,960 |

**Assumptions:** SWA calculated the savings for this measure using nameplate data taken on the day of the field visit and using the billing analysis. It was assumed that the existing boiler will be replaced with one (1) boiler of approximately 110 MBH.

**Rebates/financial incentives:**

*NJ Clean Energy – Gas-fired boilers <300 MBH ($2.00 per MBH but not less than $300 per unit)*
*Maximum incentive amount is $300.*

**Options for funding ECM:**

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

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

## ECM#4: Replace old bar refrigerator and old kitchen ice maker with Energy Star models

**Description:**

On the day of the site visit, SWA observed that there is (1) old refrigerator in the Bar area and (1) old kitchen ice maker which are not Energy Star rated (using approximately 773 kWh/yr and up to 5,000 kWh/yr respectively). Appliances, such as refrigerators and 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 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.1a | Replace (1) old bar refrigerator with an 18 cu ft model in kind | Energy Star procurement site, similar projects | 700 | 0 | 700 | 50 | 0.0 | 0 | 0.0 | 50 | 60 | 12 | 719 | 11.7 | 3 | 0 | 0 | -107 | 90 |
| 4.1b | Incremental difference to replace (1) old bar refrigerator with an 18 cu ft Energy Star model | Same as above | 50 | 0 | 50 | 300 | 0.1 | 0 | 0.1 | 0 | 60 | 12 | 716 | 0.8 | 1333 | 111 | 119 | 521 | 537 |
| 4.1 (a+b) | Replace (1) old bar refrigerator with an 18 cu ft Energy Star model | Same as above | 750 | 0 | 750 | 350 | 0.1 | 0 | 0.1 | 50 | 120 | 12 | 1,436 | 6.3 | 91 | 8 | 12 | 414 | 627 |
| 4.2a | Replace (1) old kitchen icemaker model in kind | Energy Star procurement site, similar projects | 2,400 | 0 | 2,400 | 50 | 0.0 | 0 | 0.0 | 50 | 60 | 12 | 719 | 40.0 | -70 | -6 | -15 | -1,754 | 90 |
| 4.2b | Incremental difference to replace (1) old kitchen icemaker with an Energy Star model | Same as above | 400 | 0 | 400 | 750 | 0.3 | 0 | 0.2 | 0 | 149 | 12 | 1,791 | 2.7 | 348 | 29 | 36 | 1,035 | 1,343 |
| 4.2 (a+b) | Replace one (1) old kitchen icemaker with an Energy Star model | Same as above | 2,800 | 0 | 2,800 | 800 | 0.3 | 0 | 0.3 | 50 | 209 | 12 | 2,510 | 13.4 | -10 | -1 | -2 | -719 | 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 enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

## ECM#5: Install 24.8 kW PV system

**Description:**

Currently the Independence Fire Department 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's 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. It is recommended at this time that the Independence Fire Department further review installing a 24.8 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Independence Fire Department may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. PSE&G provides the ability to buy SREC's at $600/MWh or best market offer.

The building has a flat roof which can accommodate a 24.8 kW PV installation. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 24.8 kW system needs approximately 108 panels which would take up 1,890 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: $161,460 (including $72,657 total labor cost)
Source of cost estimate: Similar projects

**Economics (with incentives):**

| 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 24.8 kW PV with Incentives | Similar Projects | 186,300 | 24,840 | 161,460 | 23,682 | 24.8 | 0 | 7.7 | 0 | 18,933 | 25 | 331,118 | 8.5 | 1 | 0 | 9 | 83,461 | 42,403 |

**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 - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50 kW or less. Incentive amount for this application is $24,840 for the proposed option.*

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

*NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 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. A total annual SREC credit of $13,800 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.*

**Options for funding ECM:**

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

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

## ECM#6: Replace gas heating/electric cooling split HVAC systems with high efficiency systems

### Description:

The Kitchen/Gym Area, Second Floor Meeting Room (Front) and Second Floor Recreation Room (Rear) are each heated and cooled by a gas-fired furnace with split system DX cooling, with condensing units located either on the roof or on grade. These systems should be replaced. This equipment was installed in 1968, 1987 and 1974 respectively and is beyond the end of its expected service life of 15 years. In addition, the condensing unit of the split system serving the Bar was installed in 1987 and is beyond its expected service life. Due to low usage of the electric heat and portion of the air handling unit for this system, replacement of the air handler yields negligible energy savings. SWA recommends replacement of the three split systems and one condensing unit to gain increase in operating efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life energy savings opportunity.

The current equipment is operating with a cooling Seasonal Energy Efficiency Ratio (SEER) of approximately 6.0-7.0. The new equipment should have a minimum 14.0 EER rating. The higher SEER will involve increased cost for the equipment over units with lower SEER. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

### Installation cost:

Estimated installed cost: $28,512 (including $8,554 labor)
Source of cost estimate: Manufacturer’s data and similar projects

## Economics (with incentives):

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.1 | Replace 4-ton gas heating / electric cooling split HVAC systems - 2nd Flr Rear addition with high eff 14 SEER system | Similar projects | 9,000 | 668 | 8,332 | 3,657 | 1.5 | 105 | 2.2 | 150 | 998 | 15 | 14,966 | 8.4 | 80 | 5 | 8 | 3,303 | 7,705 |
| 6..2 | Replace 3.5-ton gas heating / electric cooling split HVAC systems - Kitchen/Gym with high eff 14 SEER system | Similar projects | 7,500 | 622 | 6,878 | 2,400 | 1.0 | 130 | 2.0 | 150 | 776 | 15 | 11,643 | 8.9 | 69 | 5 | 7 | 2,186 | 5,730 |
| 6.3 | Replace 4-ton gas heating / electric cooling split HVAC systems - 2nd Flr over Garage with high eff 14 SEER system | Similar projects | 9,000 | 668 | 8,332 | 2,742 | 1.1 | 155 | 2.4 | 150 | 873 | 15 | 13,092 | 9.5 | 57 | 4 | 6 | 1,878 | 6,618 |
| 6.4 | Replace 2.5-ton electric heating/electric cooling split condensing unit - Bar with high eff 14 SEER system | Similar projects | 5,500 | 530 | 4,970 | 1,720 | 0.7 | 0 | 0.6 | 150 | 492 | 15 | 7,384 | 10.1 | 49 | 3 | 5 | 797 | 3,080 |

**Assumptions:** SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis, and by estimating the total of 1,200 cooling hours for one year using weather bin data for Maguire Air Force Base, Trenton, NJ.

**Rebates/financial incentives:**

*NJ Clean Energy - Gas Heating < 300 MBH ($2.00 per MBH, minimum $300 per unit)*
*Unitary HVAC <5.4 tons and Min. 14.0 SEER ($92/ton)*
*Maximum incentive amount is $2,488.*

**Options for funding ECM:**

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

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

## ECM#7: Replace 7.5 HP vehicle exhaust fan motor with Premium Efficiency

**Description:**

The rooftop vehicle exhaust fan is in good condition and should be retained. It was assumed that the vehicle exhaust fan is utilized during maintenance and cleaning of the vehicles, therefore SWA estimated 500 annual hours runtime for the fan. The fan motor is rated at 7.5 horsepower and is standard efficiency. Replacement of the entire fan assembly cannot be justified by energy savings alone, and the system still has a significant service life remaining. Therefore, SWA recommends replacement of the motor with a premium NEMA efficiency motor.

**Installation cost:**

Estimated installed cost: $466 (includes $140 of labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | Replace (1) 7.5 HP vehicle exhaust fan motor with Premium Efficiency | similar projects, DOE International Motor Master selection & savings analysis | 556 | 90 | 466 | 220 | 0.1 | 0 | 0.1 | 0 | 44 | 20 | 876 | 10.6 | 88 | 4 | 7 | 168 | 394 |

**Assumptions:** SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used. SWA estimated that the fan operates for 500 hours per year.

**Rebates/financial incentives:**

*NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)*
*Maximum incentive amount is $90.*

**Options for funding ECM:**

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

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

## ECM#8: Replace boilers main basement with high efficiency condensing boilers

**Description:**

The existing boilers in the Main Basement are a little over halfway through their expected service life and are relatively inefficient as compared to modern condensing boilers. This boiler should be considered for replacement to achieve energy savings. The initial efficiency of the existing boiler is approximately 70%, but it can be assumed that in the time since its installation, it has degraded to an efficiency of about 65%. An upgrade to a condensing boiler of minimum 85% combustion efficiency cannot be justified by energy savings alone, so this upgrade should be considered as part of a capital improvement project within the facility.

The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% at the worst case boiler operating conditions, such as mid-fire or high-fire conditions with a return water temperature in the range of 140-160 degrees Fahrenheit, and efficiencies of up to 95% achievable with lower return water temperatures. The boiler should be Low NOx certified with a 5:1 turndown burner, PVC direct venting and direct exhaust, hydronic safety controls and interface systems. The boiler shall have compact design for easy retrofit installation, with sectional aluminum block, ASME relief valve, stainless steel burner as a minimum. The air blower should be variable speed combustion with easily removable access panels.

**Installation cost:**

Estimated installed cost: $13,775 (includes $6,199 of labor)
Source of cost estimate: Manufacturer's data and similar projects

**Economics:**

| ECM # | ECM description | source | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Replace boilers main basement with high efficiency condensing boilers | Similar projects | 15,000 | 1,225 | 13,775 | 0 | 0.0 | 565 | 5.4 | 0 | 646 | 25 | 16,145 | 21.3 | 17 | 1 | 1 | -2,690 | 6,228 |

**Assumptions:** SWA calculated the savings for this measure using nameplate data taken on the day of the field visit and using the billing analysis. It was assumed that the existing boiler will be replaced with two (2) boilers of approximately 350 MBH.

**Rebates/financial incentives:**

*NJ Clean Energy - Gas-fired boilers >= 300 MBH- 1500 MBH ($1.75 per MBH)*
*Maximum incentive amount is $1,225.*

**Options for funding ECM:**

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

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

## ECM#9: Replace gas DHW heaters with Energy Star natural gas condensing type models

**Description:**

There are two (2) natural gas floor-mounted domestic water heaters, one located in the Basement Boiler Room and one located in the Gym/Hose Room. Both heaters produce the domestic hot water for the nearby toilet rooms as well as the adjacent kitchen sink. Both water heaters utilize a 40 gallon storage tank. One heater was installed in 1997 and is in fair condition, and the other was installed in 2001 and is in good condition. Based on the age and expected service life of 10-15 years, the Independence Fire Department may wish to replace these heaters with more efficient, direct vent, gas-fired tank type heaters as part of a capital improvement plan.

**Installation cost:**

Estimated installed cost: $4,450 (includes $1,240 of labor)
Source of cost estimate: Manufacturer's data and similar projects

**Economics (with incentives):**

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9a | Replace (2) gas DHW heaters with 40 gal storage in kind | Energy Star purchasing and procurement site, similar projects | 2,550 | 0 | 2,550 | 0 | 0.0 | 20 | 0.2 | 0 | 23 | 12 | 274 | 111.5 | -89 | -7 | -24 | -2,253 | 220 |
| 9b | Incremental difference to replace (2) gas DHW heaters with Energy Star natural gas condensing type models | Energy Star purchasing and procurement site, similar projects | 2,000 | 100 | 1,900 | 0 | 0.0 | 92 | 0.9 | 0 | 105 | 12 | 1,262 | 18.1 | -34 | -3 | -6 | -839 | 1,014 |
| 9 (a+ b) | Replace (2) gas DHW heaters with Energy Star natural gas condensing type models | Energy Star purchasing and procurement site, similar projects | 4,550 | 100 | 4,450 | 0 | 0.0 | 112 | 1.1 | 0 | 128 | 12 | 1,536 | 34.8 | -65 | -5 | -13 | -3,092 | 1,235 |

**Assumptions:** SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The new high efficiency gas fired water heater would operate with an efficiency of approximately 95%.

**Rebates/financial incentives:**

*NJ Clean Energy - Gas Water Heaters <50 Gal ($50 per water heater) - Maximum incentive amount is $100.*

**Options for funding ECM:**

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

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

# 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:**

*Pleases see the above recommended 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 several existing cooling systems and insufficient domestic hot water use.*

## 5.6 Geothermal

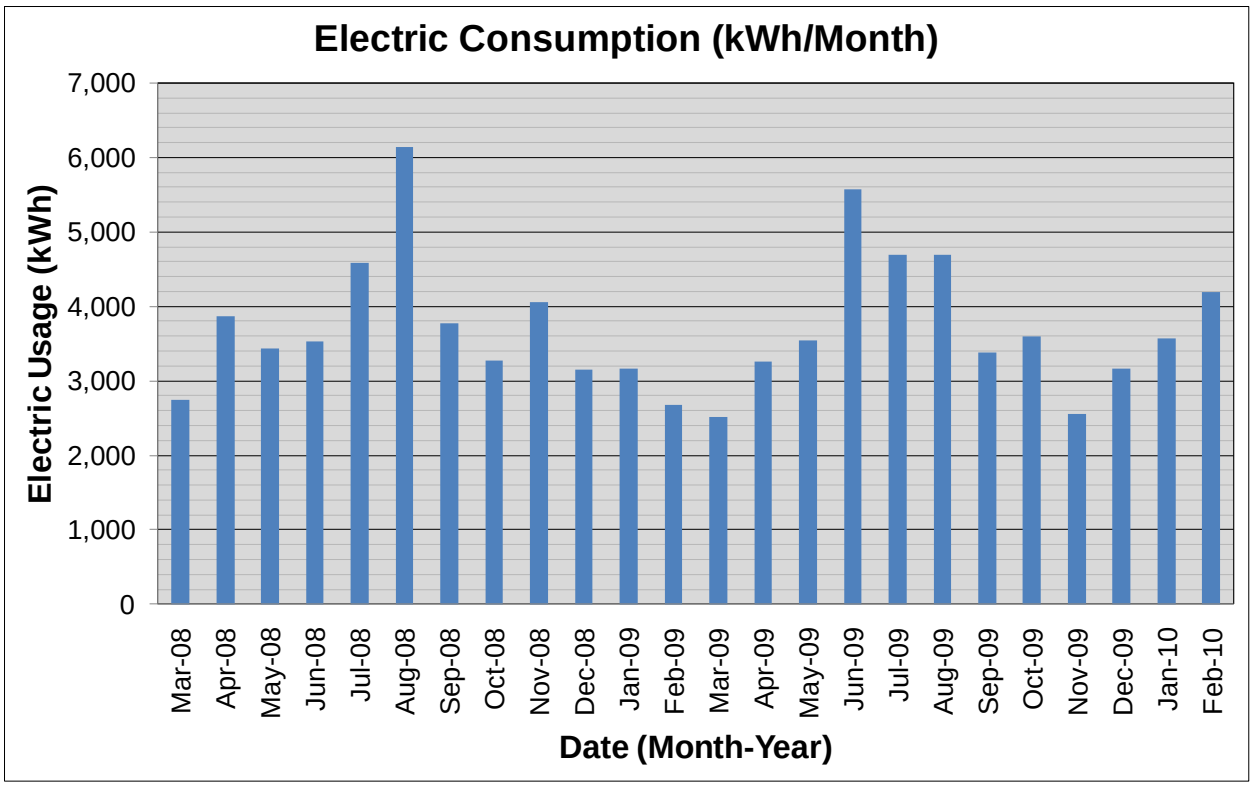
**Description:**

*Geothermal would not be cost effective since the system cost would be prohibitive as compared to the minimal usage and savings.*

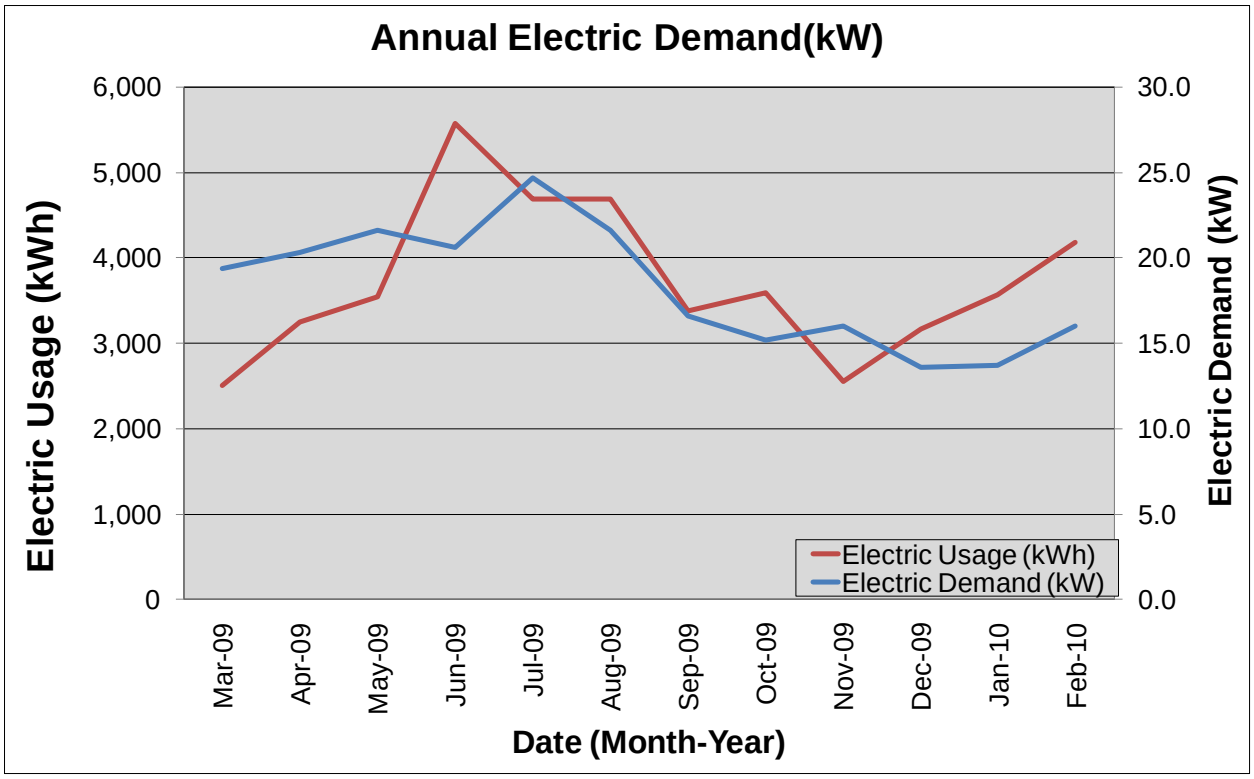
# 6 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

## 6.1 Load Profiles

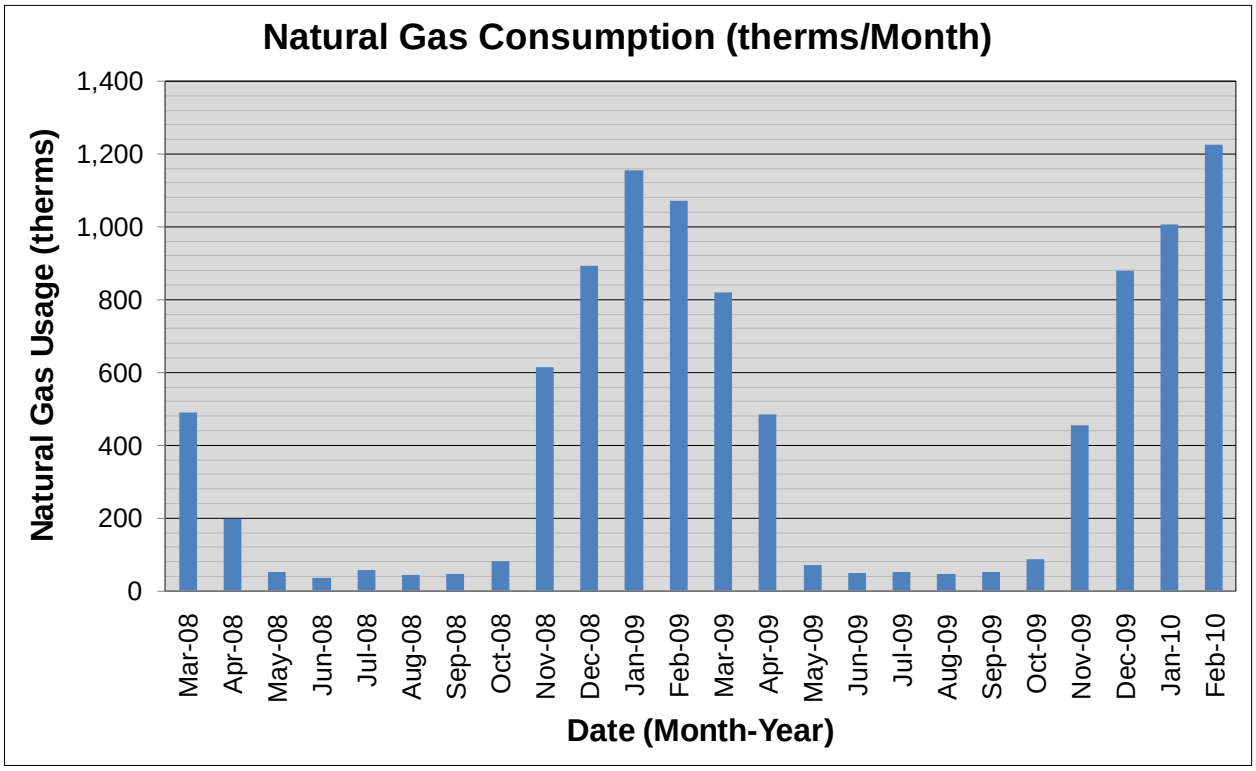
The following are charts that show the annual electric and natural gas load profiles for the Palmyra Firehouse. For annual electric and natural gas usage please also see Section 1 Historic Energy Consumption.

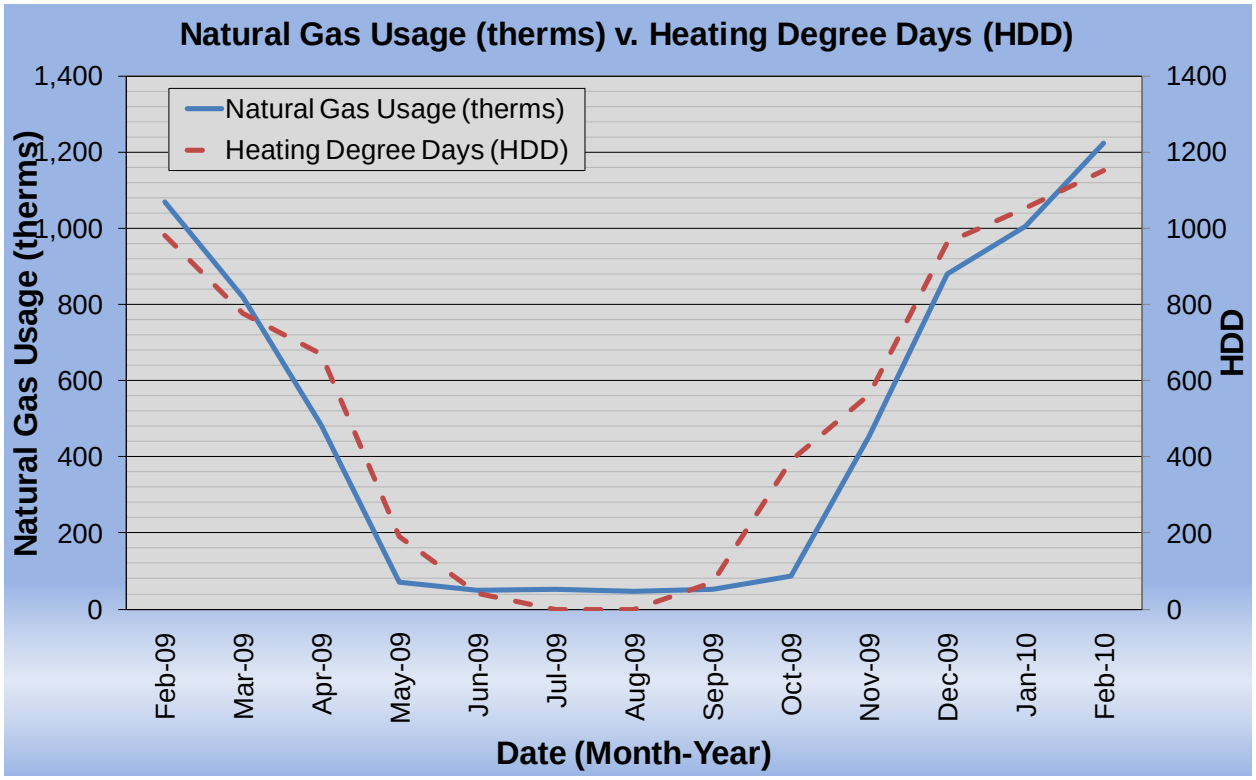



Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



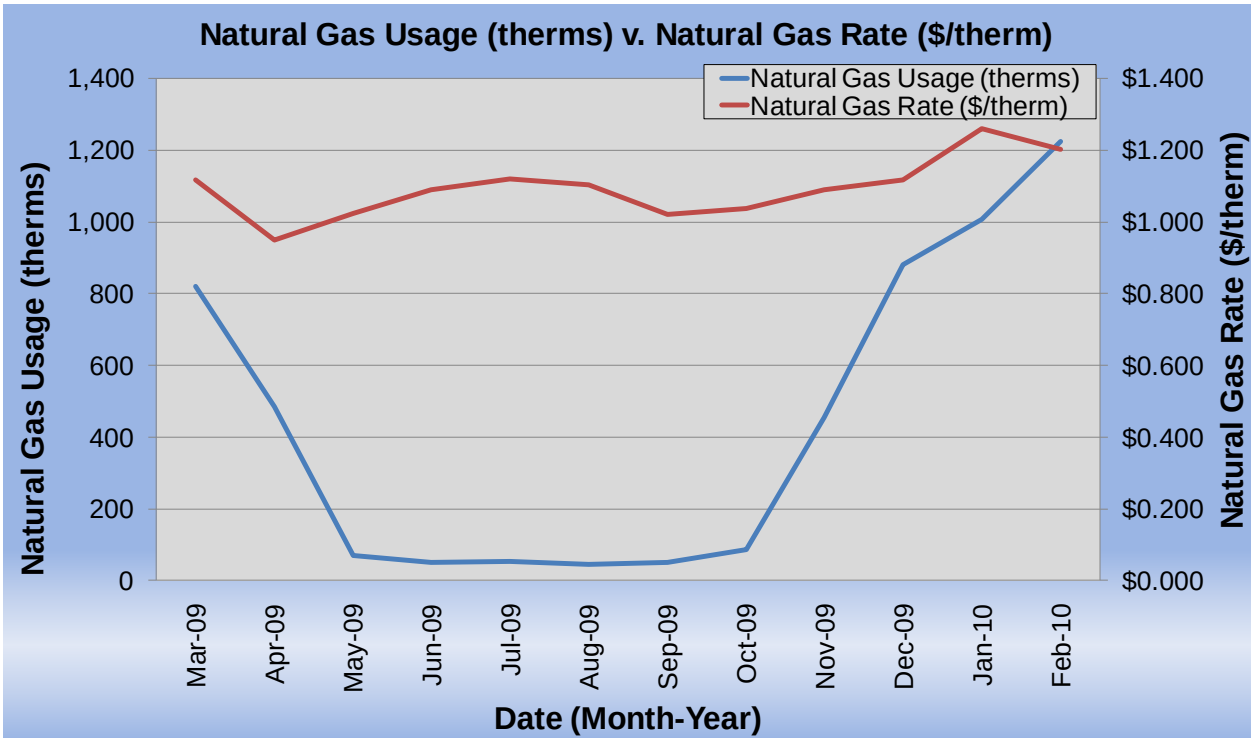
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



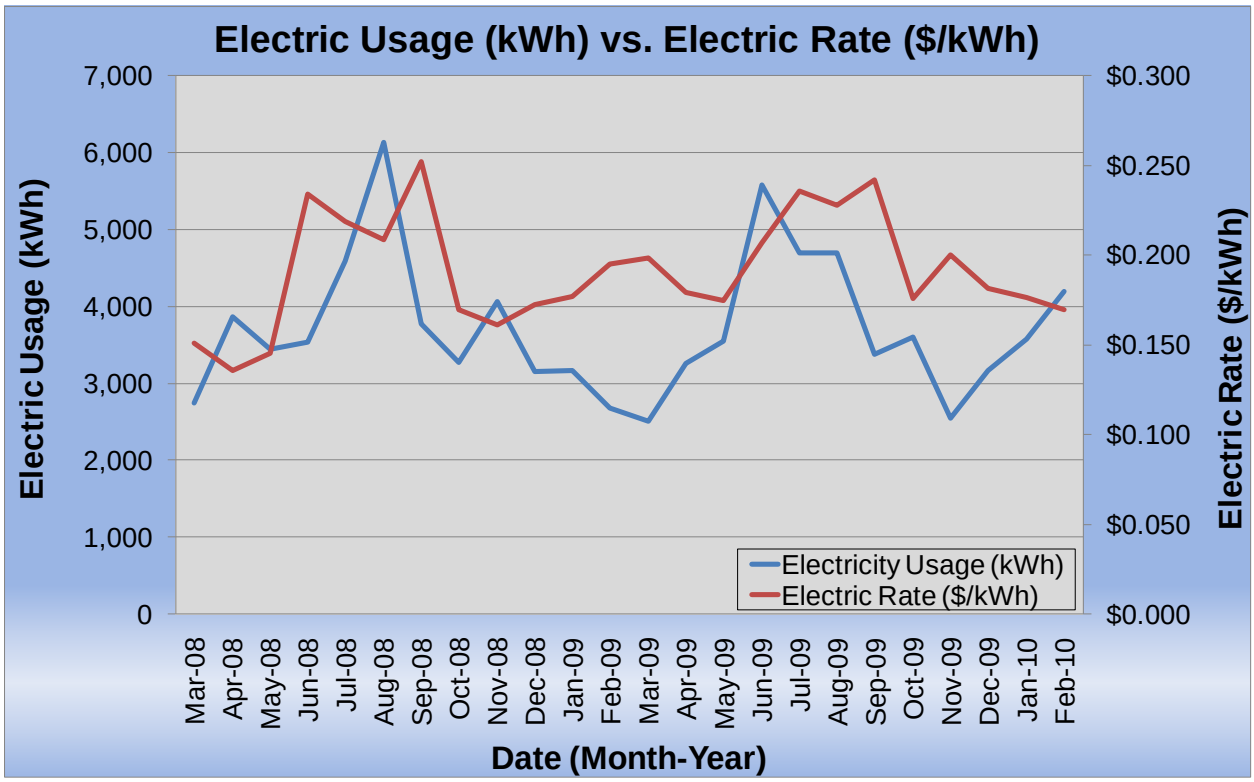



## 6.2 Tariff Analysis

Currently, natural gas is provided to the Firehouse via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by the 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 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 boiler. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use minimum payments 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 Firehouse is direct-metered and currently purchases electricity from the PSE&G at a general service rate. The general service rate for electric charges is market-rate based on use and the 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 air conditioning systems.

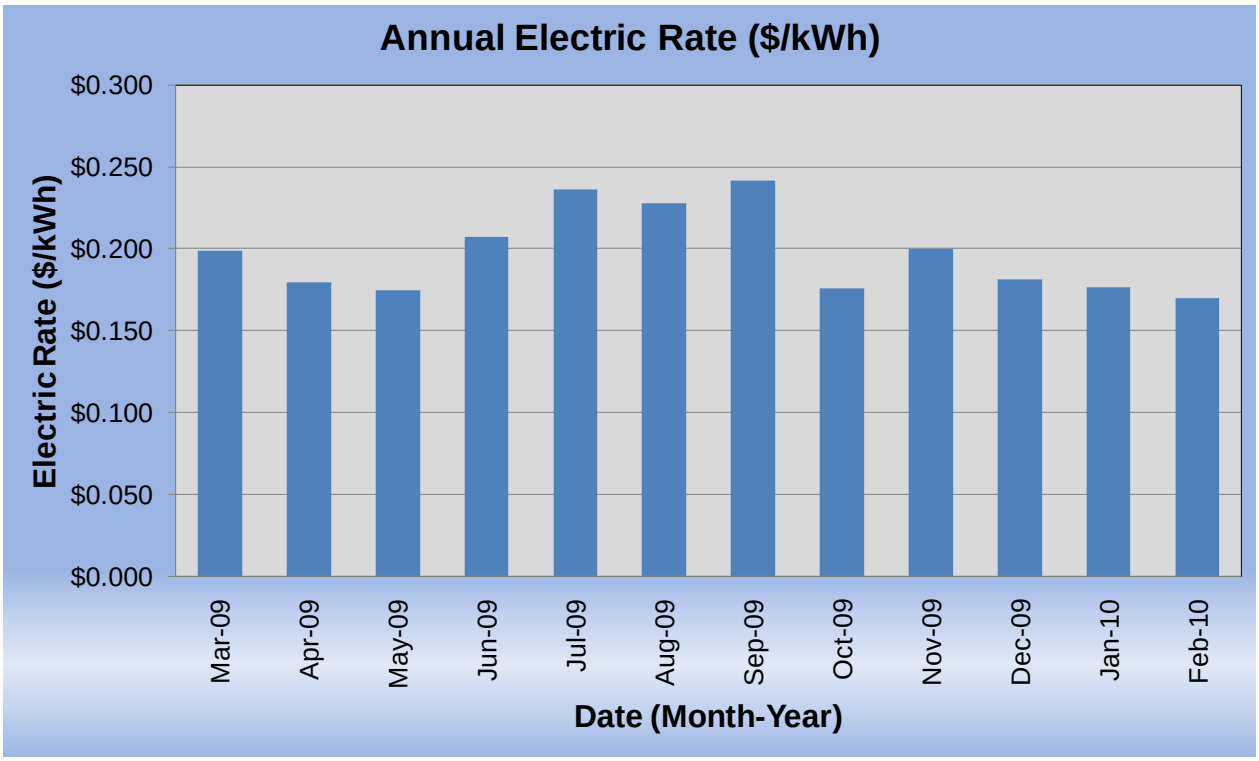


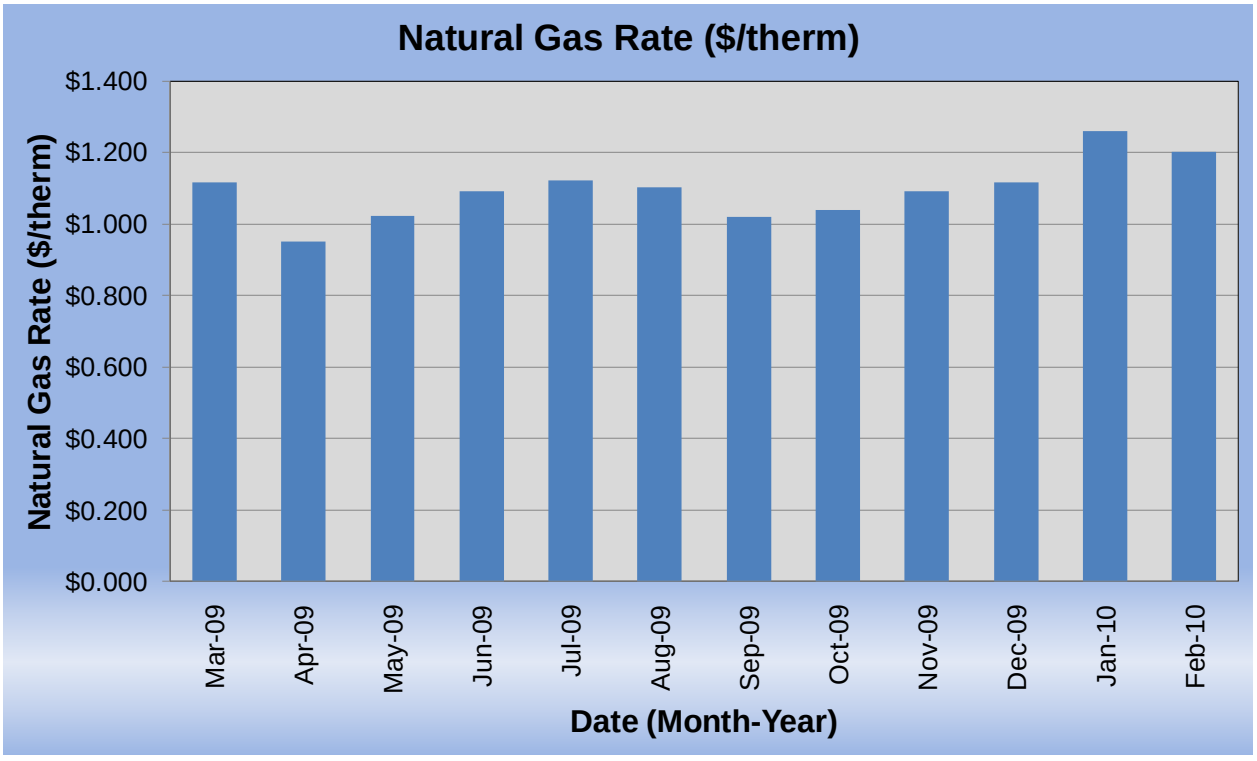

### 6.3 Energy Procurement strategies

The 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 Firehouse from PSE&G without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 29% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 14% 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 have been 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 Firehouse annual natural gas costs are competitive and the electric costs are $2,193 higher when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of Palmyra 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 Firehouse. Appendix B contains a complete list of third party energy suppliers for the Borough of Palmyra service area. The Borough of Palmyra 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 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. There is however a plan to install a bigger natural gas driven generator to be shared with the future Community Center. The following chart show the Firehouse monthly electric and natural gas spending per unit of energy in 2009.



# 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 | 1 | Table & Chair Rm | Recessed | M | 8'T12 | 1 | 2 | 80 | S | 1 | 365 | 35 | 195 | 71 | T8 | Recessed | 8'T8 | E | S | 1 | 2 | 59 | 1 | 365 | 13 | 131 | 48 | 23 | 0 | 23 |
| 2 | 1 | Table & Chair Rm | Screw-in | N | CFL | 1 | 1 | 23 | S | 1 | 365 | 0 | 23 | 8 | N/A | Screw-in | CFL | N | S | 1 | 1 | 23 | 1 | 365 | 0 | 23 | 8 | 0 | 0 | 0 |
| 3 | 1 | Gear Locker | Screw-in | N | CFL | 1 | 1 | 23 | S | 1 | 365 | 0 | 23 | 8 | N/A | Screw-in | CFL | N | S | 1 | 1 | 23 | 1 | 365 | 0 | 23 | 8 | 0 | 0 | 0 |
| 4 | 1 | All Purpose Rm | Recessed | M | 8'T12 | 1 | 2 | 80 | S | 1 | 365 | 35 | 195 | 71 | T8 | Recessed | 8'T8 | E | S | 1 | 2 | 59 | 1 | 365 | 13 | 131 | 48 | 23 | 0 | 23 |
| 5 | 1 | Engr Locker | Recessed | M | 4'T12 | 2 | 4 | 40 | S | 1 | 365 | 24 | 368 | 134 | T8 | Recessed | 4'T8 | E | S | 2 | 4 | 32 | 1 | 365 | 13 | 282 | 103 | 31 | 0 | 31 |
| 6 | 1 | Engr Locker | Recessed | M | 8'T12 | 1 | 2 | 80 | S | 1 | 365 | 35 | 195 | 71 | T8 | Recessed | 8'T8 | E | S | 1 | 2 | 59 | 1 | 365 | 13 | 131 | 48 | 23 | 0 | 23 |
| 7 | 1 | Ladies Aux Supply | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 8 | 1 | Tunnel | Recessed | M | 4'T12 | 6 | 2 | 40 | S | 3 | 365 | 15 | 570 | 624 | T8 | Recessed | 4'T8 | E | S | 6 | 2 | 32 | 3 | 365 | 6 | 420 | 460 | 164 | 0 | 164 |
| 9 | 1 | Tunnel | Screw-in | N | CFL | 1 | 1 | 23 | S | 3 | 365 | 0 | 23 | 25 | N/A | Screw-in | CFL | N | S | 1 | 1 | 23 | 3 | 365 | 0 | 23 | 25 | 0 | 0 | 0 |
| 10 | 1 | Ladies Aux | Recessed | M | 4'T12 | 6 | 4 | 40 | S | 1 | 365 | 24 | 1,104 | 403 | T8 | Recessed | 4'T8 | E | S | 6 | 4 | 32 | 1 | 365 | 13 | 846 | 309 | 94 | 0 | 94 |
| 11 | 1 | Ladies Aux | Recessed | M | 4'T12 | 1 | 4 | 40 | OS | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | OS | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 12 | 1 | Bathroom | Screw-in | N | Inc | 1 | 1 | 60 | S | 1 | 365 | 0 | 60 | 22 | CFL | Screw-in | CFL | N | S | 1 | 1 | 15 | 1 | 365 | 0 | 15 | 5 | 16 | 0 | 16 |
| 13 | 1 | Closet | Screw-in | N | Inc | 1 | 2 | 60 | S | 1 | 365 | 0 | 120 | 44 | CFL | Screw-in | CFL | N | S | 1 | 2 | 15 | 1 | 365 | 0 | 30 | 11 | 33 | 0 | 33 |
| 14 | 1 | Kitchenet | Screw-in | N | Inc | 1 | 2 | 60 | S | 1 | 365 | 0 | 120 | 44 | CFL | Screw-in | CFL | N | S | 1 | 2 | 15 | 1 | 365 | 0 | 30 | 11 | 33 | 0 | 33 |
| 15 | 1 | Hose Rm | Recessed | M | 4'T12 | 4 | 4 | 40 | S | 1 | 365 | 24 | 736 | 269 | T8 | Recessed | 4'T8 | E | S | 4 | 4 | 32 | 1 | 365 | 13 | 564 | 206 | 63 | 0 | 63 |
| 16 | 1 | Ready Rm/Bar | Screw-in | N | Inc | 11 | 1 | 65 | S | 1 | 365 | 0 | 715 | 261 | CFL | Screw-in | CFL | N | S | 11 | 1 | 15 | 1 | 365 | 0 | 165 | 60 | 201 | 0 | 201 |
| 17 | 1 | Ready Rm/Bar | Screw-in | N | Inc | 11 | 1 | 65 | S | 2 | 365 | 0 | 715 | 522 | CFL | Screw-in | CFL | N | S | 11 | 1 | 15 | 2 | 365 | 0 | 165 | 120 | 402 | 0 | 402 |
| 18 | 1 | Ready Rm Rear Stairs | Screw-in | N | CFL | 1 | 1 | 14 | S | 24 | 365 | 0 | 14 | 123 | N/A | Screw-in | CFL | N | S | 1 | 1 | 14 | 24 | 365 | 0 | 14 | 123 | 0 | 0 | 0 |
| 19 | 1 | Ready Rm Rear Stairs | Screw-in | N | Inc | 1 | 1 | 60 | S | 1 | 365 | 0 | 60 | 22 | CFL | Screw-in | CFL | N | S | 1 | 1 | 15 | 1 | 365 | 0 | 15 | 5 | 16 | 0 | 16 |
| 20 | 2 | Rec Rm | Recessed | M | 4'T12 | 9 | 4 | 40 | S | 1 | 365 | 24 | 1,656 | 604 | T8 | Recessed | 4'T8 | E | S | 9 | 4 | 32 | 1 | 365 | 13 | 1269 | 463 | 141 | 0 | 141 |
| 21 | 2 | Rec Rm | Screw-in | N | Inc | 1 | 1 | 65 | S | 1 | 365 | 0 | 65 | 24 | CFL | Screw-in | CFL | N | S | 1 | 1 | 15 | 1 | 365 | 0 | 15 | 5 | 18 | 0 | 18 |
| 22 | 2 | Rec Rm Closet | Screw-in | N | Inc | 1 | 1 | 100 | S | 1 | 365 | 0 | 100 | 37 | CFL | Screw-in | CFL | N | S | 1 | 1 | 30 | 1 | 365 | 0 | 30 | 11 | 26 | 0 | 26 |
| 23 | 2 | Rec Rm Furnace Closet | Screw-in | N | Inc | 1 | 1 | 100 | S | 1 | 365 | 0 | 100 | 37 | CFL | Screw-in | CFL | N | S | 1 | 1 | 30 | 1 | 365 | 0 | 30 | 11 | 26 | 0 | 26 |
| 24 | 2 | Rec Rm Bathroom | Recessed | M | 2'T12 | 1 | 2 | 20 | S | 1 | 365 | 16 | 56 | 20 | T8 | Recessed | 2'T8 | E | S | 1 | 2 | 17 | 1 | 365 | 3 | 37 | 14 | 7 | 0 | 7 |
| 25 | 1 | Kitchen | Recessed | E | 4'T8 | 10 | 4 | 32 | S | 1 | 365 | 13 | 1,410 | 515 | N/A | Recessed | 4'T8 | E | S | 10 | 4 | 32 | 1 | 365 | 13 | 1410 | 515 | 0 | 0 | 0 |
| 26 | 1 | Men's Bathroom | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 27 | 1 | Women's Bathroom | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 28 | 1 | Truck Bay | Recessed | E | 4'T8 | 49 | 2 | 32 | S | 2 | 365 | 6 | 3,430 | 2,504 | N/A | Recessed | 4'T8 | E | S | 49 | 2 | 32 | 2 | 365 | 6 | 3430 | 2504 | 0 | 0 | 0 |
| 29 | 1 | Truck Bay | Recessed | M | 8'T12 | 2 | 2 | 80 | S | 2 | 365 | 35 | 390 | 285 | T8 | Recessed | 8'T8 | E | S | 2 | 2 | 59 | 2 | 365 | 13 | 262 | 191 | 93 | 0 | 93 |
| 30 | 1 | Lockers | Screw-in | N | Inc | 3 | 1 | 60 | S | 1 | 365 | 0 | 180 | 66 | CFL | Screw-in | CFL | N | S | 3 | 1 | 15 | 1 | 365 | 0 | 45 | 16 | 49 | 0 | 49 |
| 31 | B | Staircase | Screw-in | N | CFL | 3 | 1 | 14 | S | 1 | 365 | 0 | 42 | 15 | N/A | Screw-in | CFL | N | S | 3 | 1 | 14 | 1 | 365 | 0 | 42 | 15 | 0 | 0 | 0 |
| 32 | B | Boiler Rm | Recessed | M | 4'T12 | 2 | 2 | 40 | S | 1 | 365 | 15 | 190 | 69 | T8 | Recessed | 4'T8 | E | S | 2 | 2 | 32 | 1 | 365 | 6 | 140 | 51 | 18 | 0 | 18 |
| 33 | 1 | Front Main Flr | Exit Sign | E | Fl. | 1 | 1 | 15 | N | 24 | 365 | 2 | 17 | 149 | LEDex | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 96 | 0 | 96 |
| 34 | 1 | Main Mess Board | Recessed | M | 4'T12 | 1 | 2 | 40 | S | 24 | 365 | 15 | 95 | 832 | T8 | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 24 | 365 | 6 | 70 | 613 | 219 | 0 | 219 |
| 35 | 2 | Mtg Flr | Recessed | M | 4'T12 | 12 | 4 | 40 | S | 1 | 365 | 24 | 2,208 | 806 | T8 | Recessed | 4'T8 | E | S | 12 | 4 | 32 | 1 | 365 | 13 | 1692 | 618 | 188 | 0 | 188 |
| 36 | 2 | Chief's Office | Recessed | M | 4'T12 | 4 | 4 | 40 | S | 1 | 365 | 24 | 736 | 269 | T8 | Recessed | 4'T8 | E | S | 4 | 4 | 32 | 1 | 365 | 13 | 564 | 206 | 63 | 0 | 63 |
| 37 | 2 | Secretary | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 38 | 2 | President | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 39 | 2 | Uniform Locker | Recessed | M | 4'T12 | 1 | 4 | 40 | S | 1 | 365 | 24 | 184 | 67 | T8 | Recessed | 4'T8 | E | S | 1 | 4 | 32 | 1 | 365 | 13 | 141 | 51 | 16 | 0 | 16 |
| 40 | 2 | Bathroom | Screw-in | N | Inc | 1 | 1 | 100 | S | 1 | 365 | 0 | 100 | 37 | CFL | Screw-in | CFL | N | S | 1 | 1 | 30 | 1 | 365 | 0 | 30 | 11 | 26 | 0 | 26 |
| 41 | 2 | Mtg Rm - picture lites | Screw-in | N | Inc | 8 | 1 | 60 | S | 1 | 365 | 0 | 480 | 175 | CFL | Screw-in | CFL | N | S | 8 | 1 | 15 | 1 | 365 | 0 | 120 | 44 | 131 | 0 | 131 |
| 42 | 1 | Front Doors | Screw-in | N | CFL | 11 | 1 | 14 | S | 8 | 365 | 0 | 154 | 450 | N/A | Screw-in | CFL | N | S | 11 | 1 | 14 | 8 | 365 | 0 | 154 | 450 | 0 | 0 | 0 |
| 43 | Ext | Front Doors Memorial | Screw-in | N | CFL | 1 | 1 | 14 | S | 1 | 365 | 0 | 14 | 5 | N/A | Screw-in | CFL | N | S | 1 | 1 | 14 | 1 | 365 | 0 | 14 | 5 | 0 | 0 | 0 |
| 44 | Ext | Flood Lites | Screw-in | E | MH | 2 | 1 | 100 | S | 12 | 365 | 25 | 250 | 1,095 | PSMH | Screw-in | PSMH | E | S | 2 | 1 | 65 | 12 | 365 | 14 | 158 | 692 | 403 | 0 | 403 |
| 45 | Ext | 16 Garages | Recessed | M | 4'T12 | 32 | 2 | 40 | S | 1 | 365 | 15 | 3,040 | 1,110 | T8 | Recessed | 4'T8 | E | S | 32 | 2 | 32 | 1 | 365 | 6 | 2240 | 818 | 292 | 0 | 292 |
| 46 | Ext | Pole Light | Screw-in | E | MH | 1 | 1 | 400 | T | 12 | 365 | 100 | 500 | 2,190 | PSMH | Screw-in | PSMH | E | T | 1 | 1 | 250 | 12 | 365 | 54 | 304 | 1332 | 858 | 0 | 858 |
| 47 | Ext | Flood Lites | Screw-in | E | MH | 2 | 1 | 100 | T | 12 | 365 | 25 | 250 | 1,095 | PSMH | Screw-in | PSMH | E | T | 2 | 1 | 65 | 12 | 365 | 14 | 158 | 692 | 403 | 0 | 403 |
| 48 | Ext | Ladies Entrance | Screw-in | N | CFL | 1 | 1 | 14 | T | 12 | 365 | 0 | 14 | 61 | N/A | Screw-in | CFL | N | T | 1 | 1 | 14 | 12 | 365 | 0 | 14 | 61 | 0 | 0 | 0 |
| **Totals:** | | | | | | **217** | **102** | **2,693** | | | | **699** | **22,001** | **15,641** | | | | | | **217** | **102** | **1,610** | | | **350** | **16,229** | **11,349** | **4,292** | **0** | **4,292** |

**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) | | | |

| Proposed Lighting Summary Table | | | |
|---|---|---|---|
| Total Surface Area (SF) | 10,500 | | |
| Average Power Cost ($/kWh) | 0.1990 | | |
| **Exterior Lighting** | **Existing** | **Proposed** | **Savings** |
| Exterior Annual Consumption (kWh) | 5,556 | 3,600 | **1,956** |
| Exterior Power (watts) | 4,068 | 2,888 | **1,180** |
| **Internal Lighting** | **Existing** | **Proposed** | **Savings** |
| Annual Consumption (kWh) | 10,085 | 7,848 | **4,193** |
| Lighting Power (watts) | 17,933 | 13,556 | **4,377** |
| Lighting Power Density (watts/SF) | 1.71 | 1.29 | **0.42** |
| | | | |
| Estimated Cost of Fixture Replacement ($) | **22,015** | | |
| Estimated Cost of Controls Improvements ($) | **0** | | |
| **Total Consumption Cost Savings ($)** | **1,652** | | |

## Appendix B: Third Party Energy Suppliers (ESCOs)

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

| PSE&G ELECTRICAL SERVICE TERRITORY<br>Last Updated: 06/15/09 | | |
|---|---|---|
| **Hess Corporation**<br>1 Hess Plaza<br>Woodbridge, NJ 07095<br>(800) 437-7872<br>www.hess.com | **BOC Energy Services, Inc.**<br>575 Mountain Avenue<br>Murray Hill, NJ 07974<br>(800) 247-2644<br>www.boc.com | **Commerce Energy, Inc.**<br>4400 Route 9 South,<br>Suite 100<br>Freehold, NJ 07728<br>(800) 556-8457<br>www.commerceenergy.com |
| **Constellation NewEnergy, Inc.**<br>900A Lake Street,<br>Suite 2<br>Ramsey, NJ 07446<br>(888) 635-0827<br>www.newenergy.com | **Direct Energy Services, LLC**<br>120 Wood Avenue<br>Suite 611<br>Iselin, NJ 08830<br>(866) 547-2722<br>www.directenergy.com | **FirstEnergy Solutions Corp.**<br>300 Madison Avenue<br>Morristown, NJ 07962<br>(800) 977-0500<br>www.fes.com |
| **Glacial Energy of New Jersey, Inc.**<br>207 LaRoche Avenue<br>Harrington Park, NJ 07640<br>(877) 569-2841<br>www.glacialenergy.com | **Integrys Energy Services, Inc.**<br>99 Wood Ave, South,<br>Suite 802<br>Iselin, NJ 08830<br>(877) 763-9977<br>www.integrysenergy.com | **Liberty Power Delaware, LLC**<br>Park 80 West<br>Plaza II, Suite 200<br>Saddle Brook, NJ 07663<br>(866) 769-3799<br>www.libertypowercorp.com |
| **Liberty Power Holdings, LLC**<br>Park 80 West<br>Plaza II, Suite 200<br>Saddle Brook, NJ 07663<br>(866) 769-3799<br>www.libertypowercorp.com | **Pepco Energy Services, Inc.**<br>112 Main St.<br>Lebanon, NJ 08833<br>(800) ENERGY-9 (363-7499)<br>www.pepco-services.com | **PPL EnergyPlus, LLC**<br>811 Church Road<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 Floor<br>Woodbridge, NJ 07095<br>(877) 273-6772<br>www.semprasolutions.com | **South Jersey Energy Company**<br>One South Jersey Plaza<br>Route 54<br>Folsom, NJ 08037<br>(800) 800-756-3749<br>www.south jerseyenergy.com | **Suez Energy Resources NA, Inc.**<br>333 Thornall Street<br>6th Floor<br>Edison, NJ 08837<br>(888) 644-1014<br>www.suezenergyresources.com |
| **UGI Energy Services, Inc.**<br>704 East Main Street<br>Suite 1<br>Moorestown, NJ 08057<br>(856) 273-9995<br>www.ugienergyservices.com | | |

| 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 Borough, 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

**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.

**Gas Rate and Electric Rate ($/therm and $/kWh):** The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

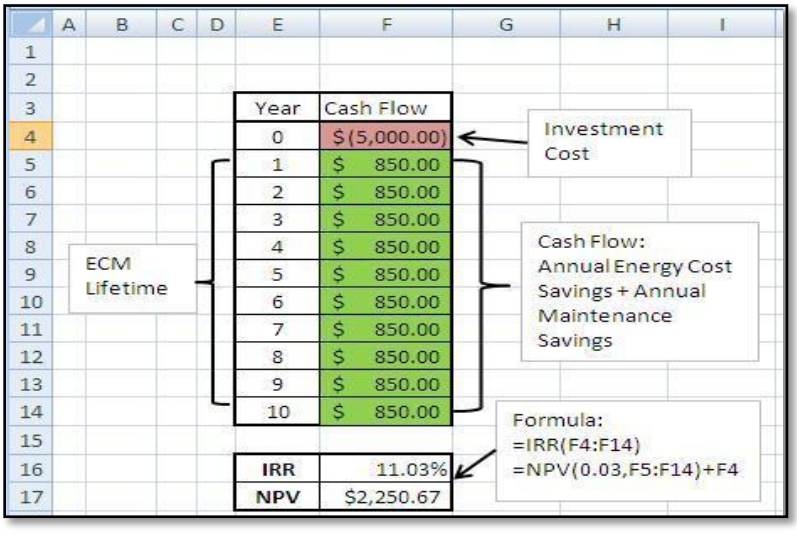
## Calculation References

| Term | Definition |
|---|---|
| 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 |
| 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)] |

* 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).

### 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:



## Solar PV ECM Calculation

There are several components to the calculation:

| | |
|---|---|
| Costs: | Material of PV system including panels, mounting and net-metering + Labor |
| Energy Savings: | Reduction of kWh electric cost for life of panel, 25 years |
| Incentive 1: | NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost |
| Incentive 2: | Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh) |
| Assumptions: | A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey. |

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

## 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.

## New Jersey Clean Energy Program Commercial & Industrial Lifetimes

| Measure | Life Span |
|---|---|
| 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 |

## APPENDIX D: INCENTIVE PROGRAMS

### New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

### Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

### Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government,

and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

**Renewable Energy Incentive Program***

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

**Utility Sponsored Programs**

Check with your local utility companies for further opportunities that may be available.

**Energy Efficiency and Conservation Block Grant Rebate Program**

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG

**Other Federal and State Sponsored Programs**

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.