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Local Government Energy Program
Energy Audit Final Report

South River Appleby Avenue Firehouse
South River, NJ 08882

Project Number: LGEA48

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INTRODUCTION

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

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

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

This report addresses the South River Appleby Avenue Firehouse located at 2nd Street and Appleby Avenue, South River, NJ 08882. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The single-story South River Appleby Avenue Firehouse was originally built in 1959 with the latest additions / renovations occurring in 1980 and 2006. The building consists of 7,400 square feet of conditioned space. The building houses the Summit Engine Co. - 1 truck bay newer section next to 2 truck bay older section, a lounge, a bathroom and offices. Occupancy for the Appleby Avenue Firehouse is sporadic, usually 2 to 5 volunteers for approximately 4 hours per day. There is usually one special event / training held in the lounge every couple of months for volunteer firemen members.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of South River to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Appleby Avenue 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 Appleby Avenue Firehouse located at 2nd Street and Appleby Avenue, South River, NJ 08882. The Appleby Avenue Firehouse is a single-story building comprising of a total floor area of 7,400 square feet. The original structure was built in 1959 with the latest addition / renovation occurring in 1980 and 2006.

Based on the field visits performed by the SWA staff on January 5th, 11th and 12th and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, natural gas and electric usage.

From November 2008 through October 2009 the Appleby Avenue Firehouse consumed 60,900 kWh or $7,917 worth of electricity at an approximate rate of $0.130/kWh and 2,431 therms or $2,912 worth of natural gas at an approximate rate of $1.198/therm. The joint energy consumption for the building, including both electricity and natural gas, was 451 MMBtu of energy that cost a total of $10,829.

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

The Site Energy Use Intensity is 60 kBtu/ft^{2}yr compared to the national average of Borough Fire Station building consuming 78 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 6.4 kBtu/ft^{2}yr, which when implemented would make the building energy consumption even better than the national average.

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

Category I Recommendations: Capital Improvement Measures

- Replace the electric domestic hot water (DHW) heater
- Replace common area heating equipment
- Replace window air conditioners
- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- Replace asphalt shingle roof finish due to age and condition
- Replace all single glazed windows with a low-E type with the next major renovation

Category II Recommendations: Operations and Maintenance

- Slope perimeter grade away from building to maximize site drainage
- Maintain / repair garage doors
- Thoroughly and evenly insulate space above the ceiling

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts and cap flashing - repair / install missing downspouts and cap flashing as needed
- Provide weather stripping / air sealing
- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **2** Energy Conservation Measures (ECMs) for the Appleby Avenue Firehouse that is summarized in the following Table 1. The total investment cost for these ECMs without incentives is **$1,579**. SWA estimates a first year savings of **$1,014** with a simple payback of **1.6 years**. SWA also recommends **2** more ECMs with a total first year savings of **$443** that is summarized in Table 2 and **2** recommended End of Life Cycle ECMs with a total first year savings of **$490** that is summarized in Table 3. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Appleby Avenue Firehouse by **21,005 lbs of CO_2**, which is equivalent to removing approximately 2 cars from the roads each year or avoiding the need of 51 trees to absorb the annual CO_2 generated.

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

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	install (1) Drinks vending machine energy miser - in bay behind brush truck	www.usatech .com and established costs	279	0	279	1,456	0.0	0	0.7	0	189	12	2,271	1.5	714	60	68	1,534	2,607
2.1	replace (10) incandescent, (8) halogen and (8) Metal Halide bulbs with CFLs	RS Means, Lit Search	1,300	0	1,300	5,939	0.0	0	2.7	53	825	5	4,123	1.6	217	43	57	2,379	10,634
	Totals		**1,579**	**0**	**1,579**	**7,395**	**0.1**	**0**	**3.4**	**53**	**1,014**	**-**	**6,394**	**1.6**	**305**	**-**	**59**	**3,912**	**13,241**

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

Table 2 - Recommended 5-10 Year Payback ECMs																			
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3	replace (1) old 80% eff lounge furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	2,300	0	2,300	984	0.0	91	1.7	110	347	15	5,207	6.6	126	8	13	1,729	2,767
4	replace one (1) old Bar refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	750	0	750	350	0.0	0	0.2	50	96	12	1,146	7.9	53	4	7	183	627
	Totals		**3,050**	**0**	**3,050**	**1,334**	**0.0**	**91**	**1.8**	**160**	**443**	**-**	**6,353**	**6.9**	**108**	**-**	**11**	**1,913**	**3,393**

Table 3 - Recommended End of Life Cycle ECMs																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.2	replace (28) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	6,020	0	6,020	1,641	0.0	0	0.8	123	336	15	5,037	17.9	-16	-1	-2	-2,004	2,938
5	replace one (1) old Bar icemaker with an Energy Star model	Energy Star purchasing and procurement site, similar projects	2,800	0	2,800	800	0.0	0	0.4	50	154	12	1,848	18.2	-34	-3	-6	-1,245	1,432
	Totals		**8,820**	**0**	**8,820**	**2,441**	**0.0**	**0**	**1.1**	**173**	**490**	**-**	**6,885**	**18.0**	**-22**	**-**	**-3**	**-3,250**	**4,371**

1. HISTORIC ENERGY CONSUMPTION

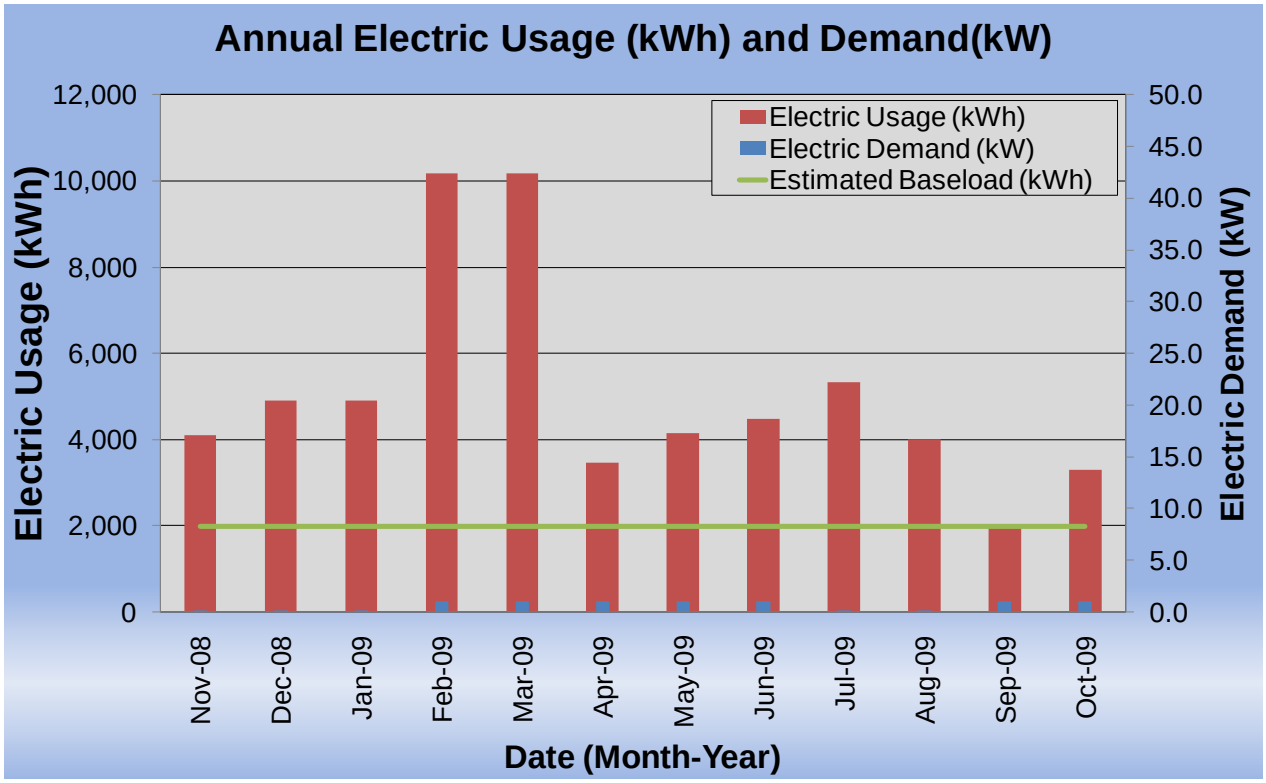
1.1. Energy Usage and Cost Analysis

SWA analyzed two years of utility bills from December 2007 through October 2009 that were received from the utility companies supplying the South River Appleby Avenue Firehouse with electric and natural gas.

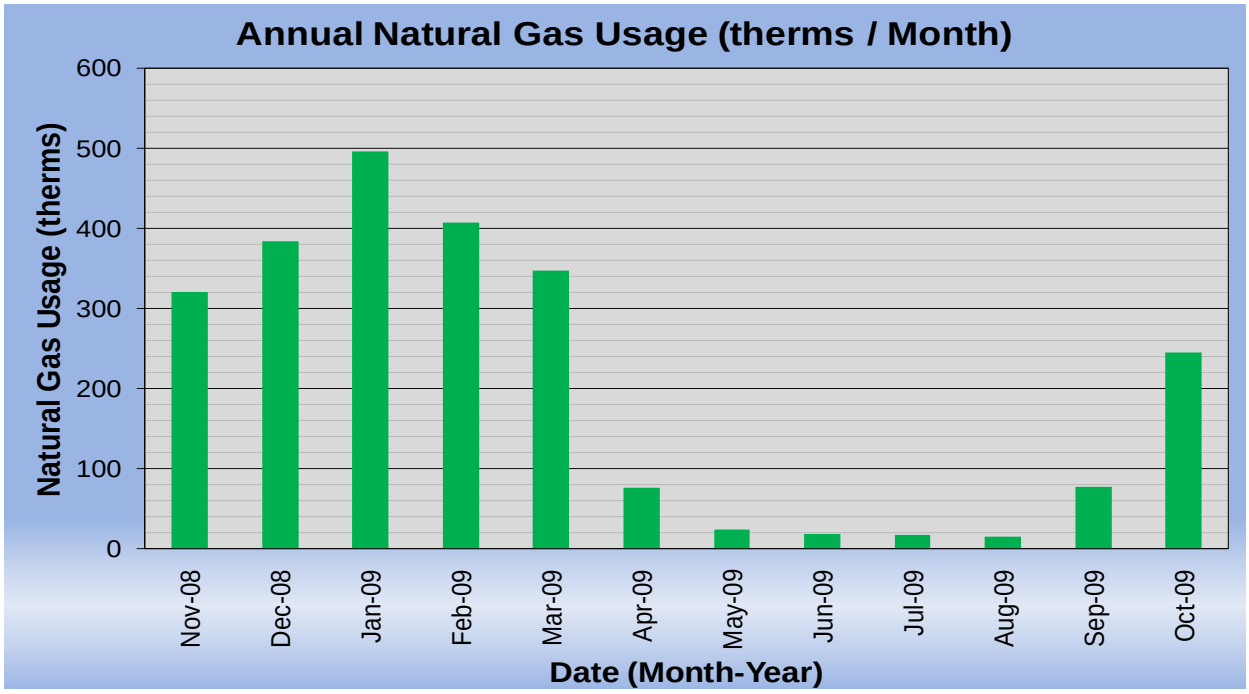
Electricity - The South River Appleby Avenue Firehouse is currently served by one electric meter. The Appleby Avenue Firehouse currently buys electricity from South River Electric Utility at **an average rate of $0.130/kWh** based on 12 months of utility estimates from November 2008 through October 2009. The Appleby Avenue Firehouse purchased **approximately 60,900 kWh or $7,917 worth of electricity** in the previous year. The average monthly demand was 1 kW.

Natural gas - The South River Appleby Avenue Firehouse is currently served by one meter for natural gas. The South River Appleby Avenue Firehouse currently buys natural gas from PSE&G at **an average aggregated rate of $1.198/therm** based on 12 months of utility bills for November 2008 through October 2009. The South River Appleby Avenue Firehouse purchased **approximately 2,431 therms or $2,912 worth of natural gas** in the previous year at a very competitive rate.

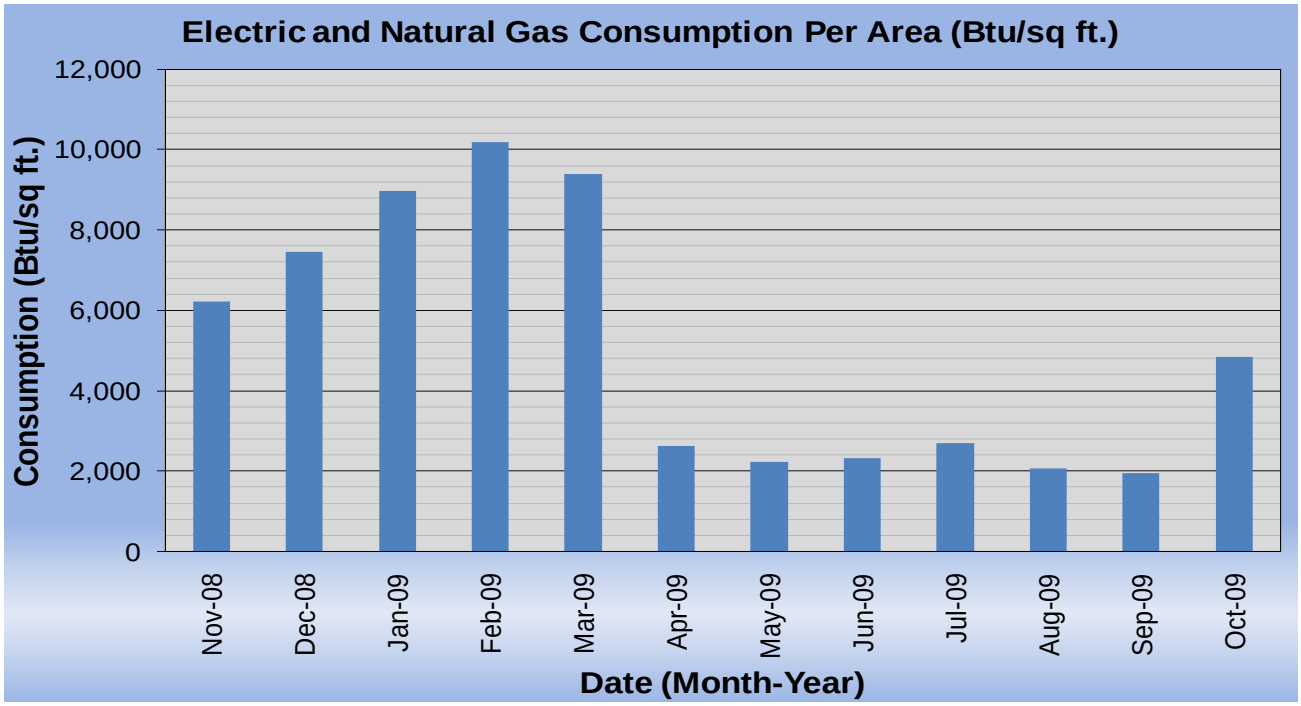
The following chart shows electricity consumption for the Appleby Avenue Firehouse based on electric bills for the 12 month period of November 2008 through October 2009.



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

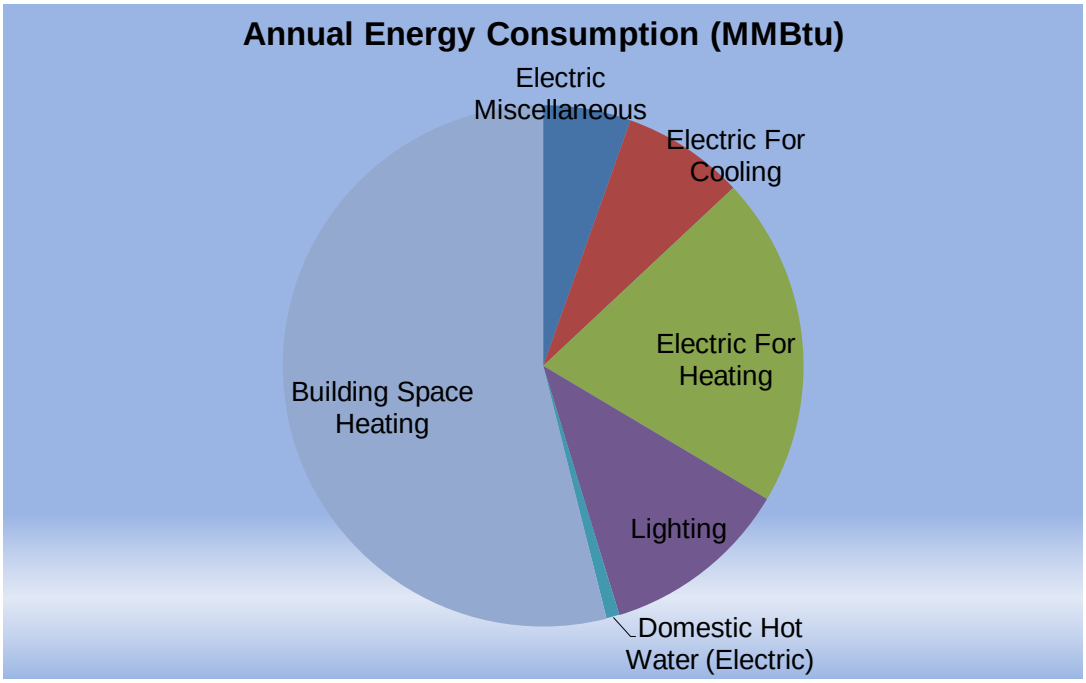


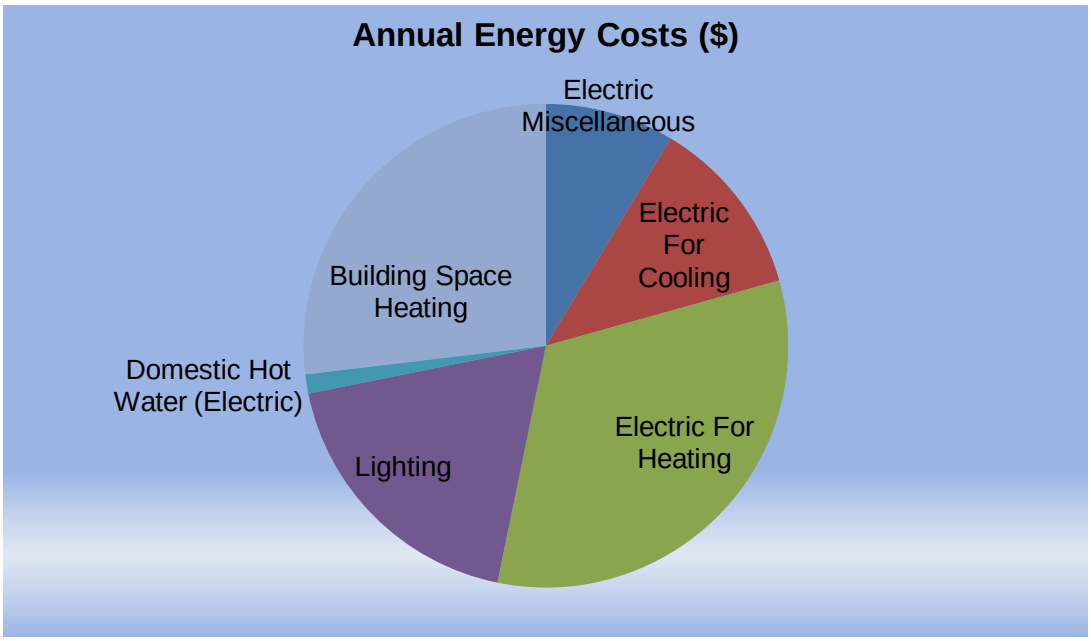
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Appleby Avenue Firehouse based on estimates and utility bills for the 12 month period of November 2008 through October 2009.



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

2009 Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	25	5%	$934	9%	38
Electric For Cooling	34	8%	$1,303	12%	38
Electric For Heating	93	21%	$3,526	33%	38
Lighting	53	12%	$2,016	19%	38
Domestic Hot Water (Electric)	4	1%	$139	1%	38
Building Space Heating	243	54%	$2,912	27%	12
Totals	451	100%	$10,829	100%	24
Total Electric Usage	208	46%	$7,917	73%	38
Total Gas Usage	243	54%	$2,912	27%	12
Totals	451	100%	$10,829	100%	24





1.2. Utility Rate

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

The Appleby Avenue Firehouse currently purchases natural gas supply 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 Appleby Avenue Firehouse currently. The average aggregated rate (supply and transport) for the meter is approximately $1.198/therm based on 12 months of utility bills for November 2008 through October 2009.

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

1.3. Energy Benchmarking

SWA has entered energy information about the Appleby Avenue Firehouse in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Fire Station facility is comprised of non-eligible (Other) space type. A Fire Station facility space or "Other" can be used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the Appleby Avenue Firehouse is not eligible to receive a national energy performance rating at this time however *Portfolio Manager* provides a preliminary kBtu/sq ft yr comparison.

The Site Energy Use Intensity is 60 kBtu/sq ft yr compared to the national average of a Fire Station building consuming 78 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 3.4 kBtu/sq ft yr, with an additional 1.8 kBtu/sq ft yr from the recommended ECMs and 1.1 kBtu/sq ft yr from the

recommended End of Life Cycle ECMs. These recommendations could account for at least 6.4 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption even better than the national average.

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of South River - Appleby Avenue Firehouse

Building ID: 2023923
For 12-month Period Ending: October 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 09, 2010

Facility
Borough of South River - Appleby Avenue Firehouse
2 Appleby Avenue
South River, NJ 08882

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1959
Gross Floor Area (ft²): 7,400

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	205,402
Natural Gas (kBtu)[4]	239,673
Total Energy (kBtu)	445,075

Energy Intensity[5]

Site (kBtu/ft²/yr)	60
Source (kBtu/ft²/yr)	127

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	44

Electric Distribution Utility
Borough of South River

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-19%
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 single-story South River Appleby Avenue Firehouse was originally built in 1959 with the latest additions / renovations occurring in 1980 when a lounge with heat and rooftop cooling condenser was added and in 2006 when another truck bay was added. The building consists of 7,400 square feet of conditioned space. The building houses the Summit Engine Co. - 1 truck bay newer section next to 2 truck bay older section, a lounge, a bathroom, an office, a janitor's closet and a captain / lieutenant's office.

Front Façade

Partial Side Façade (typ.)

2.2. Building Occupancy Profiles

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

2.3. Building Envelope

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

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

2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of vertical vinyl panel system and some wood clapboard siding accents over 5-1/2" framing with 5 inches of fiberglass batt cavity insulation. Other areas are constructed of brick veneer and some limestone accents over 5-1/2" framing with no detectable / assumed insulation. The interior is mostly painted CMU (Concrete Masonry Unit) and painted gypsum wallboard.

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

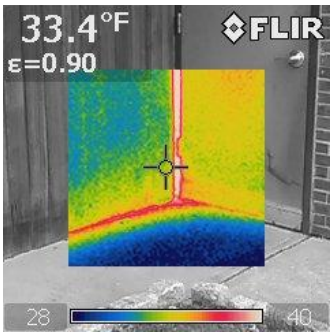
During the field audit exterior and interior wall surfaces were inspected. They were found / reported to be in overall acceptable condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues located mostly at the front of the building.

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

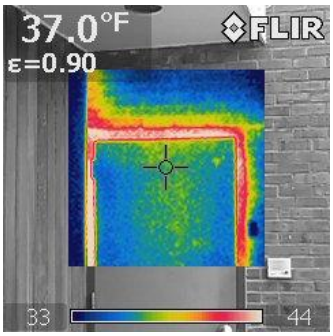
Faulty construction detail at vinyl panel termination that can promote water / moisture penetration into the wall cavity by clogging or wind driven rain.

Signs of water damage at perimeter walls due to missing / ineffective site drainage.

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



Water/ moisture issues within the exterior wall assembly.



Air-leakage at wall penetrations.

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

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

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

2.3.2. Roof

The building's roof is predominantly a flat, no parapet type over steel decking with a built-up asphalt finish and light-colored gravel ballast. It was replaced circa 1995. 3 inches of acoustic ceiling tile applied fiberglass batt attic / ceiling insulation and no detectable / assumed roof insulation were recorded. Other parts of the building are also covered by a low-pitch gable type over a wood structure with an asphalt shingle finish and 6 inches of acoustic tile applied fiberglass batt attic / ceiling and no detectable / assumed roof insulation. This roof was replaced approximately 20 years ago.

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

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

The following specific roof problem spots and areas were identified:

The roofing material has reached the end of its useful lifespan.

Missing / deteriorating wood trim / moldings

Clogged/ ineffective gutters

Missing / deteriorating wood trim / moldings

Delaminating roof membrane / patches

Signs of mold / water damage on interior finishes

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

1. Replace asphalt shingle roof finish due to age and condition.

2. Install / repair and maintain roof fascia / wood trim and moldings.

3. Repair / patch flat roof finish.

4. Clean gutters and downspouts.

2.3.3. Base

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

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

The building's base and 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 good condition with no signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

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

2.3.4. Windows

The building contains several different types of windows.

1. 4 fixed type windows with a wood frame, clear single glazing and interior drapes. They are located on the front of the building and appear to be original / have never been replaced.
2. 7 fixed / casement type windows with a vinyl frame, clear double glazing and no interior or exterior shading devices . They are located throughout the building, especially in the newer parts.

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 good condition, except for the single glazed units, with little to no signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues, again except for the single glazed units.

The following specific window problem spots and areas were identified:

Single glazed window with ineffective frame

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

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

1. Replace all original / single glazed windows with a low-E, double glazed type.

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

2.3.5. Exterior Doors

The building contains several different types of exterior doors.

1 3 insulated hollow core type exterior doors. They are located throughout the building and seem original / have never been replaced.
2 3 overhead type exterior doors. They are located in the front of the building and are original / have never been replaced.

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 good / 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

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

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

2.3.6. Building Air Tightness

Overall, the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, as described in more detail in the previous sections.

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 and wall areas that are part of or penetrate the exterior envelope and where air-leakage can occur.

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

2.4. HVAC Systems

The Appleby Avenue Firehouse heating is provided by a number of individual wall electric heaters in offices and a hot air furnace in the lounge room, while the truck bays are heated by ceiling hung gas heaters. Cooling of several offices is provided by window and wall units with the lounge cooled by a split system with a rooftop condenser.

2.4.1. Heating

The building is heated by a few wall electric heaters, each controlled by local manual knobs. These radiators and convectors are located in the offices and bathroom. They are very old and past their expected useful operating lives. The lounge is heated by an 80% efficient natural gas fired furnace operating beyond its estimated useful life. There weren't many complaints about the ability of the heating system to provide adequate comfort to the building occupants. SWA recommends replacement with updated units controlled by programmable thermostats. SWA also recommends replacing the lounge furnace with a 93% efficient condensing type unit. The building, including the truck bays, is generally maintained at 62 deg F when unoccupied. SWA was told that this is the optimum temperature to startup the truck diesel engines and also provide an easy recovery to higher temperatures as activities may need to ramp up.

Heating two of the three truck bays is provided by 2 ceiling hung gas fired heaters, a Modine and a Reznor, each capable of 125 MBtu/hr input, 80% efficient, installed in 2006 and having approximately 70% left of their expected service lives of 15 years. The third truck bay does not have its own heater.

2.4.2. Cooling

The Appleby Avenue Firehouse cooling in office areas is provided by window and through the wall air conditioning units, some of which were manufactured by Maytag. These units are 2000 vintage and have 30% left of their expected useful lives. SWA recommends replacing them with Energy Star models of high efficiency rating as they age.

The lounge and bar are cooled by a York split system with an evaporator in the furnace discharge ductwork and a rooftop mounted condenser, which was installed in 2000 and has approximately 30% left of its expected service life of 15 years.

Lounge / bar rooftop condenser

2.4.3. Ventilation

The various spaces of the building are ventilated by air conditioning units that serve the offices and lounge (furnace) as described in the "Cooling" section above. Other areas receive fresh air via infiltration / air leakage. The attic space exhaust fan keeps the attic space from overheating. The exhaust from the fire trucks is captured via rapid disengaging hoses and ducted to a rooftop exhaust system.

2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the Appleby Avenue Firehouse is provided by an electric heater with a 40 gal storage tank located in the back room. SWA recommends replacing this heater, which is operating beyond its useful operating life, with a 95% efficiency natural gas fired condensing Energy Star model (prior to catastrophic failure). However, because of the low DHW use and the competitive utility rates at this time, it is best for the time being to replace the electric DHW heater in kind with a high efficiency model.

2.5. Electrical Systems

2.5.1. Lighting

Interior Lighting - The Appleby Avenue Firehouse contains a mix of 4ft T12 fixtures with magnetic ballasts and screw-in incandescent lamps. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing the incandescent bulbs with screw-in CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to 5 times longer. SWA recommends replacing the T12 fixtures mentioned above with more efficient type fixtures. All replacements should meet local code requirements, such as shielding for safety hazards. SWA does not recommend installing occupancy sensors for this building, since payback on savings are not justified. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide & Halogen lamp fixtures. The exterior Metal Halide lighting is controlled by an automatic timer. The exterior Halogen lighting is controlled by a motion sensor. SWA recommends replacing the Halogen lamps with CFL lamps. SWA also recommends replacing the Metal Halide (MH) lamps with more efficient CFLs if financially justified. SWA is not recommending at this time any upgrades to the exterior motion sensors or automatic timers.

2.5.2. Appliances and Process

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

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions (DVDs, stereos, computers, and kitchen appliances which now have internal memories or clocks which always require a trickle of power) in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off.

2.5.3. Elevators

The Appleby Avenue Firehouse does not have an elevator.

2.5.4. Others Electrical Systems

Besides a few very small transformers and a portable 5kVA emergency generator there are not currently any other significant energy impacting electrical systems installed at the Appleby Avenue Firehouse.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	1 gas heater - ceiling hung - 125,000 Btu/hr input, 100,000 Btu/hr output - 80% est. htg. eff. with a 1/8 HP blower motor, 1625 RPM, 2.3 amps	2 truck bay area	Modine PD125AA0111; Serial #: 05011013501-9826	Natural Gas / Electric - fan	2 truck bay area	2006	70%
Heating	1 gas heater - ceiling hung - 125,000 Btu/hr input, 100,000 Btu/hr output - 80% est. htg. eff. with 1/8 HP blower motor	2 truck bay area	Reznor	Natural Gas / Electric - fan	2 truck bay area	2006	70%
Heating	1 natural gas fired furnace 75,000 Btu/hr input - 80% est. htg. eff.	lounge kitchen / bar area	York, nameplate missing	Natural Gas / Electric - fan	lounge	1995	0%
Heating	1 electric heater	captain / lieutenant's office	missing nametag	Electric	captain / lieutenant's office	1980	0%
Cooling	through the wall AC	Office	Maytag	Electric	Office	2000	30%
Cooling	window AC	captain / lieutenant's office	missing nametag or located inside window enclosure	Electric	Captain / Lieutenant 's Office	2000	30%
Cooling	condenser (R22) - est. 9.5 EER eff.	rooftop	York High Eff - HC2B036S06A; Serial #: MGXM236200	Electric	lounge	2000	30%
Domestic Hot Water	one 40 gal DHW heater (4,500 Watts htg coil)	Back Room	A. O. Smith FSG-40222; Serial #: M694-0028848-222	Electric	Firehouse	1990	0%
Genera-tor	one 5kW/5kVA generator, 3,600 rpm	storage room on side of firehouse	Kohler 5RMY62; Serial #: 217868	Natural Gas / Electric	Firehouse	1995	30%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	Firehouse	2002	50%

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

4. ENERGY CONSERVATION MEASURES

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

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

Category I Recommendations: Capital Improvements

- Replace the electric domestic hot water (DHW) heater - SWA would recommend replacing this heater, which is operating beyond its useful operating life, with a 95% efficiency natural gas fired condensing Energy Star model, prior to catastrophic failure. However, because of the low DHW use and the competitive utility rates at this time, it is best for the time being to replace the electric DHW heater in kind with a high efficiency model. This replacement in kind recommendation offers negligible energy savings.

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

- Replace window air conditioners - A couple of the existing window air conditioners have little useful life remaining (on the average 2-3 years left) but replacement should be considered with more modern, energy efficient systems. The window air conditioners could be replaced with split systems to allow for closing up of the existing window / wall penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

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

- Replace asphalt shingle roof finish due to age and condition.

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

Category II Recommendations: Operations and Maintenance

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

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

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

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

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

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

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

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

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

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

Category III Recommendations: Energy Conservation Measures - Summary Table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	install Drinks vending machine energy miser
2.1	replace incandescent, halogen and Metal Halide lamps with CFLs
	Description of Recommended 5-10 Year Payback ECMs
3	replace old 80% efficient furnace with 93% efficient condensing type furnace
4	replace old refrigerator with Energy Star type model
	Description of Recommended End of Life Cycle ECMs
2.2	replace old T12 (with magnetic ballasts) with T8 (with electronic ballasts) fixtures
5	replace old bar ice maker with Energy Star type model
	Description of Renewable ECMs
6	install a 3 kW solar PV rooftop system

ECM#1: *Install Vending Miser*

Description:

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

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

Installation cost:

Estimated installed cost: $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) Drinks vending machine energy miser - in bay behind brush truck	www.usatech.com and established costs	279	0	279	1,456	0.0	0	0.7	0	189	12	2,271	1.5	714	60	68	1,534	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.

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

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

ECM#2: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Appleby Avenue Firehouse (see Appendix A).

The interior lighting of the Appleby Avenue Firehouse consists of a mix of 4ft T12 fixtures with magnetic ballasts (most operating beyond their expected useful lives) and screw-in incandescent lamps. SWA recommends replacing the incandescent bulbs with screw-in CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to 5 times longer. SWA recommends replacing the T12 fixtures mentioned above with more efficient types if financially justified. All replacements should meet local code requirements, such as shielding for safety hazards. SWA does not recommend installing occupancy sensors for this building, since payback on savings are not justified. The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide & Halogen lamp fixtures. SWA recommends replacing the Halogen lamps with CFL lamps. SWA also recommends replacing the Metal Halide (MH) lamps with more efficient CFLs if financially justified. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of South River may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $7,320 (includes $4,979 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 (10) incandescent, (8) halogen and (8) Metal Halide bulbs with CFLs	RS Means, Lit Search	1,300	0	1,300	5,939	0.0	0	2.7	53	825	5	4,123	1.6	217	43	57	2,379	10,634
2.2a	replace (28) T12 fixtures throughout the bldg with new T12 fixtures	RS Means, Lit Search	5,600	0	5,600	0	0.0	0	0.0	88	88	15	1,313	64.0	-77	-5	-14	-4,429	0
2.2b	incremental difference to replace (28) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	420	0	420	1,641	0.0	0	0.8	35	248	15	3,725	1.7	787	52	59	2,425	2,938
2.2 (a+b)	replace (28) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	6,020	0	6,020	1,641	0.0	0	0.8	123	336	15	5,037	17.9	-16	-1	-2	-2,004	2,938

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 5 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates / Financial Incentives:

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

Options for Funding ECM:

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

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

ECM#3: *Replace Old Furnace with Condensing Type Furnace*

Description:

The existing lounge furnace is operating beyond its expected service life and should be replaced to avoid catastrophic failure. An upgrade to an Energy Star condensing furnace of 93% Annual Fuel Utilization Efficiency (AFUE) rating is recommended. Upgrades to other portions of the heating furnace system should be done at the same time. Those upgrades should include a blower with a high efficiency NEMA Premium motor, electronic ignition and programmable Energy Star thermostat.

SWA recommends a two-stage furnace which is like having two furnaces in one. On the coldest days, the furnace operates in the high-stage mode at 100% capacity. But on most days, the furnace comfortably conserves energy by operating in the low-stage mode at just 70% capacity. The two-stage gas valve runs quietly on the low stage 90% of the time, producing just 25% of the normal high-fire sound, while significantly reducing energy consumption. A central furnace control orchestrates the various functions of the furnace with digital accuracy. Functions like the blower and inducer motor are monitored for proper operation, increasing safety and reliability. SWA also recommends features like the corrosion-resistant, aluminized steel tubular heat exchanger with stainless-steel recuperative coil which will provide many years of trouble-free service. Plus, a furnace heavy-gauge, reinforced and insulated steel cabinet. The high-efficiency combustion process allows venting with 2 or 3 inch PVC without the need for a traditional chimney flue. And because it can be direct-vented to the outside, fresh air can be used for combustion. The fuel stingy auto-ignition system eliminates the old-fashioned standing pilot for greater ignition dependability without the wasted energy.

Installation cost:

Estimated installed cost: $2,300 (includes $600 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
3a	replace (1) old 80% eff lounge furnace - 75 MBH input with a model in kind	Energy Star purchasing and procurement site, similar projects	1,400	0	1,400	18	0.0	12	0.2	110	127	15	1,903	11.0	36	2	4	90	165
3b	incremental difference to replace (1) old 80% eff lounge furnace with a condensing model - 93% eff	Energy Star purchasing and procurement site, similar projects	900	0	900	966	0.0	79	1.5	0	220	15	3,304	4.1	267	18	23	1,640	2,601
3 (a+b)	replace (1) old 80% eff lounge furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	2,300	0	2,300	984	0.0	91	1.7	110	347	15	5,207	6.6	126	8	13	1,729	2,767

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

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

Options for Funding ECM:

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

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

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

Description:

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

Installation cost:

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

Economics:

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

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

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

Options for Funding ECM:

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

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

ECM#5: *Replace Old Ice Maker with an Energy Star Model*

Description:

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

Installation cost:

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

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5a	replace (1) old Bar icemaker model in kind	Energy Star purchasing and procurement site, similar projects	2,400	0	2,400	50	0.0	0	0.0	50	57	12	678	42.5	-72	-6	-16	-1,787	90
5b	incremental difference to replace (1) old Bar icemaker with an Energy Star model	Energy Star purchasing and procurement site, similar projects	400	0	400	750	0.0	0	0.3	0	98	12	1,170	4.1	193	16	22	542	1,343
5 (a+b)	replace one (1) old Bar icemaker with an Energy Star model	Energy Star purchasing and procurement site, similar projects	2,800	0	2,800	800	0.0	0	0.4	50	154	12	1,848	18.2	-34	-3	-6	-1,245	1,432

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

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

Options for Funding ECM:

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

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

ECM#6: *Install a 3 kW PV System*

Description:

Currently the South River Appleby Avenue Firehouse does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. The Borough of South River may want to review installing a 3 kW PV system to offset electrical demand and reduce the annual net electric consumption for the Appleby Avenue Firehouse. The Appleby Avenue Firehouse is not eligible for a 30% federal tax credit. The Appleby Avenue Firehouse may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. See below for more information.

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

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

SWA has considered the system size stated above. Should the Rescue Squad decide to increase the air conditioned spaces, the minimum demand would increase over the historical data cited in this analysis, and therefore further study into expanding the proposed system would be recommended.

There are many possible locations for a 3 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 3 kW system needs approximately 13 panels which would take up 228 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: $22,500 (includes $9,000 of labor)
Source of cost estimate: Similar Projects

Economics (<u>without</u> NJ EECBG Grant):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6	Install a 3 kW Solar Photovoltaic system	Similar Projects	22,500	0	22,500	3,541	3.0	0	1.6	0	460	25	11,509	48.9	0	0	-5	-14,205	6,341

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

Rebates/financial incentives:

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. An estimated SREC value of $1,800 could be realized with a traditional solar PV system setup. However since net metering is not available from the local utility, savings in the form of SRECs were NOT incorporated into the above analysis.

Options for funding ECM:

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

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

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

5.3. Solar Photovoltaic

Description:

A Solar PV System is not applicable because of insufficient financial incentives and a simple payback greater than 40 years. See ECM#6.

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 split system cooling and insufficient domestic hot water use.

5.6. Geothermal

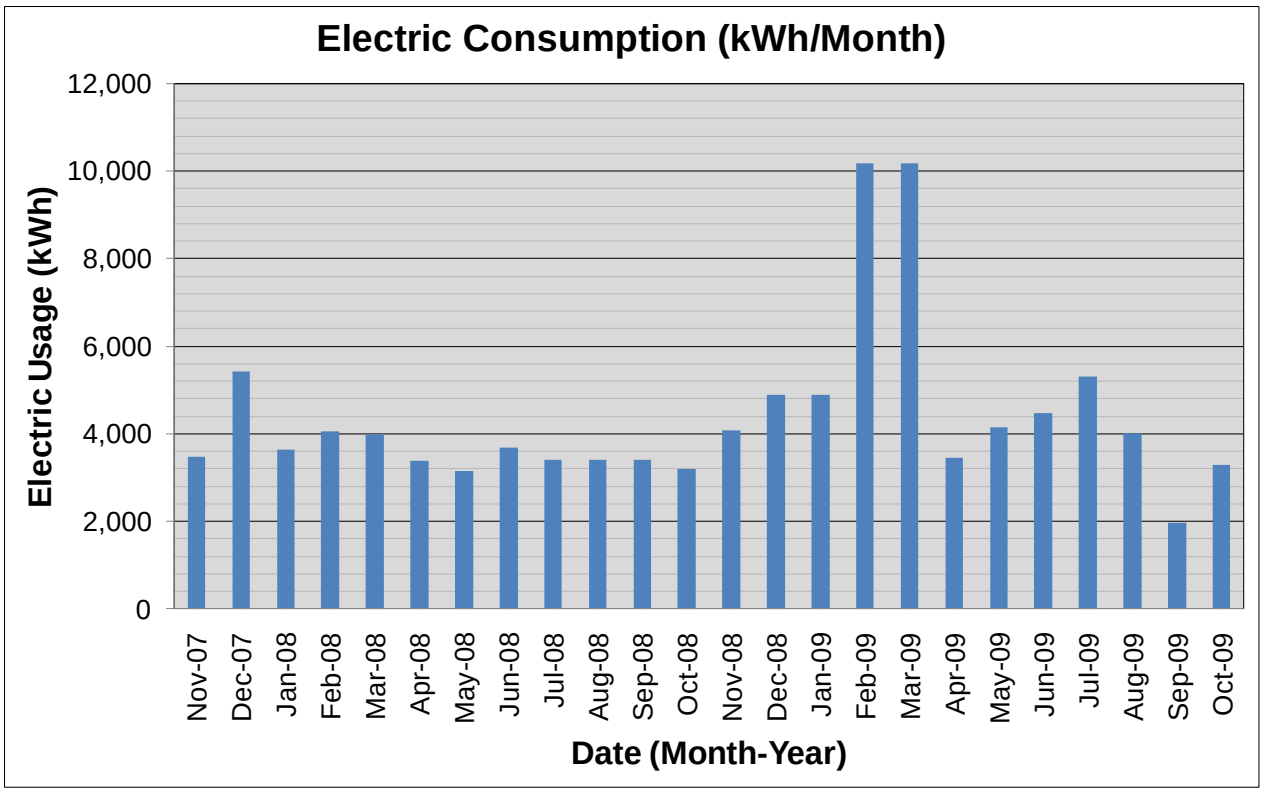
Description:

Geothermal is not applicable for this building because it would not be cost effective, since it would require replacement of the existing HVAC system, of which major components still have as a whole a number of useful operating years.

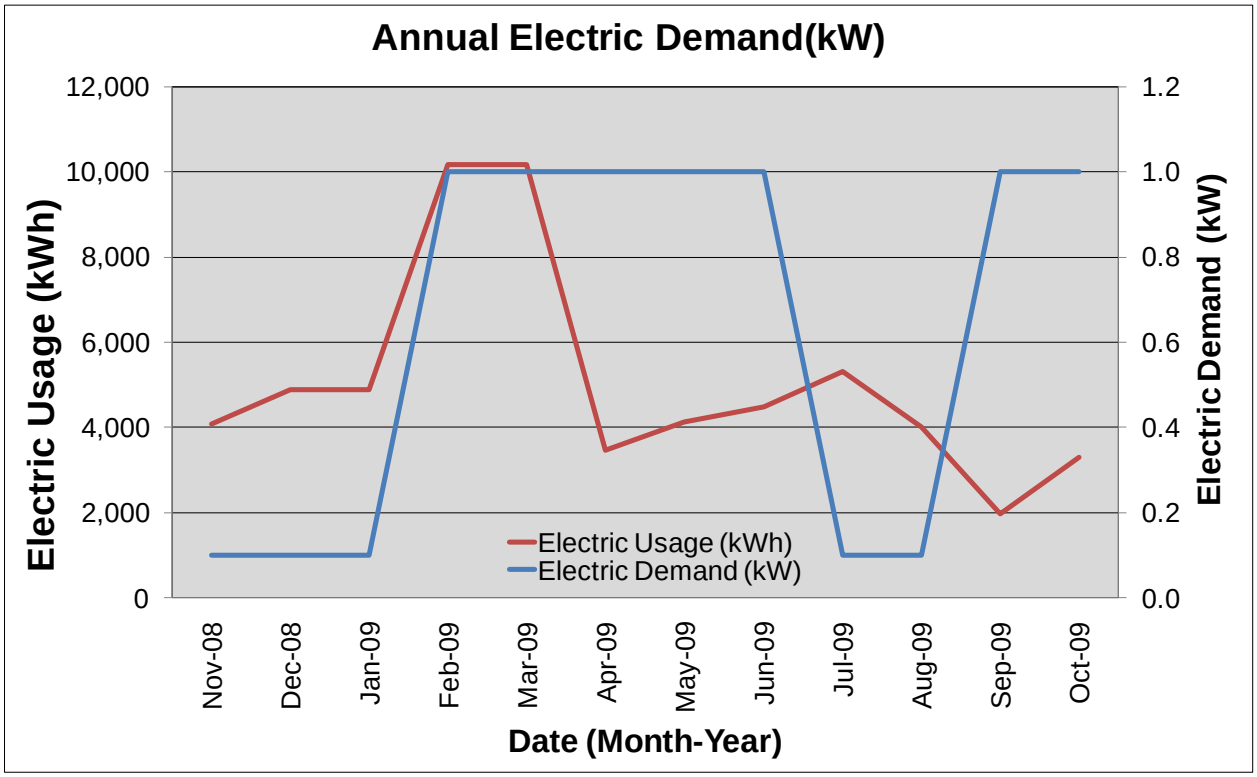
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load Profiles

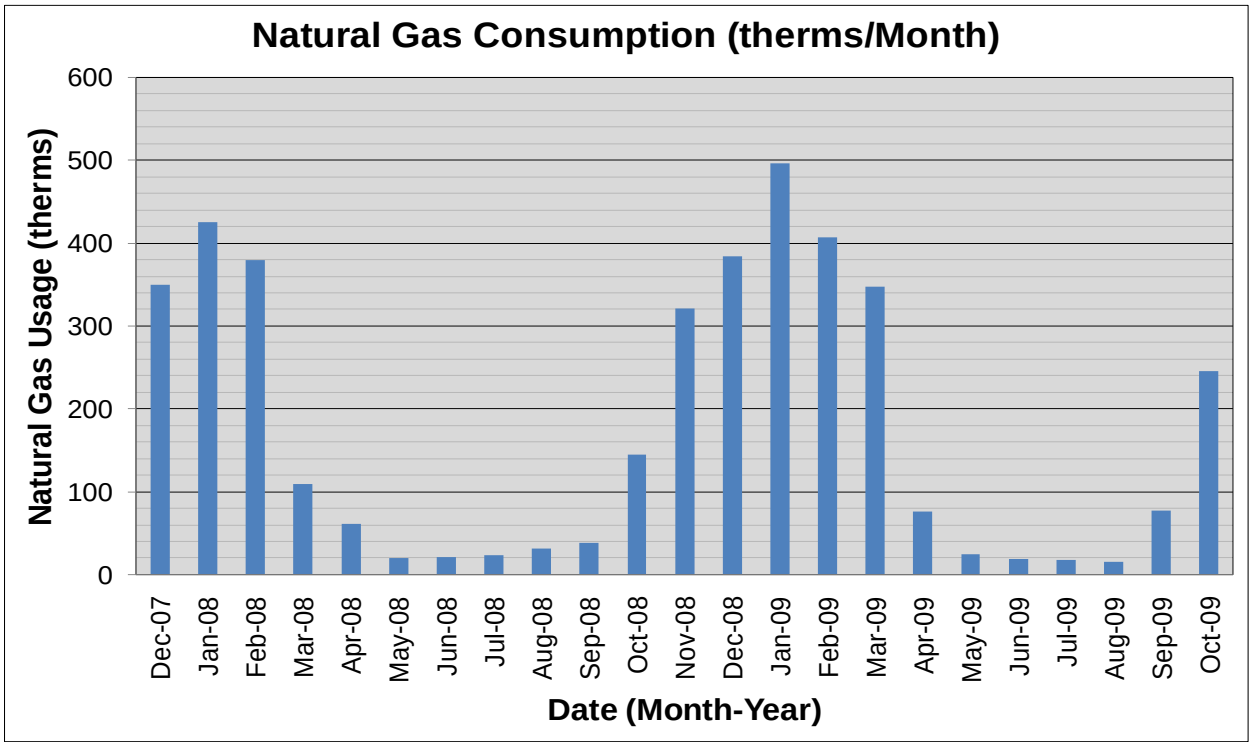
The following are charts that show the annual electric and natural gas load profiles for the South River Appleby Avenue Firehouse. For annual electric and natural gas usage please also see Section 1. Historic Energy Consumption.

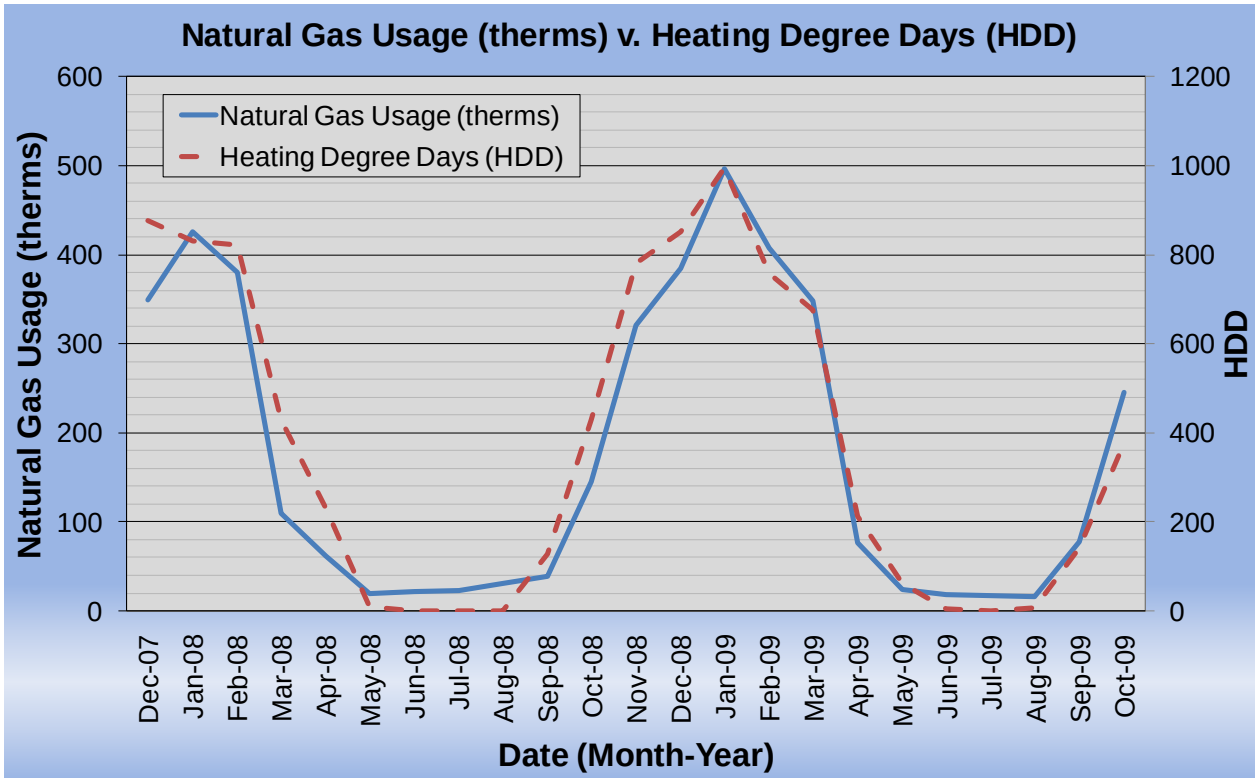


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



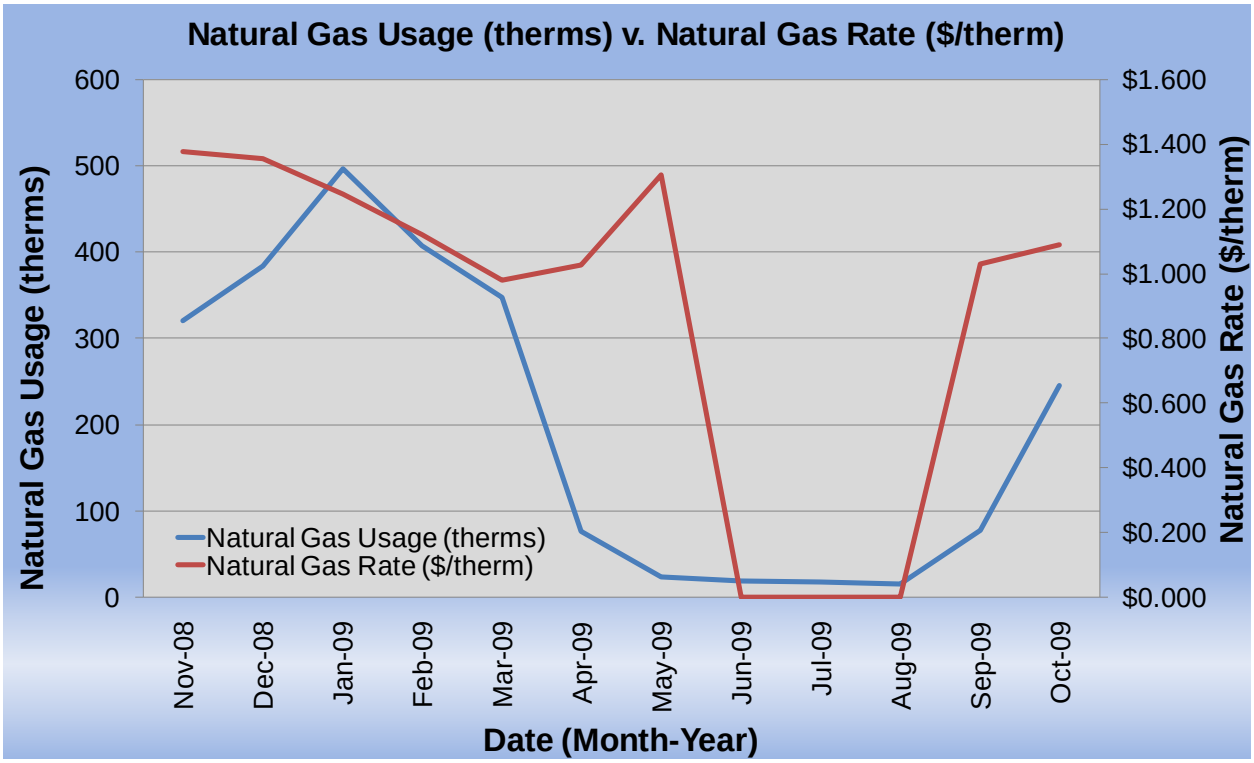
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.





6.2. Tariff Analysis

Currently, natural gas is provided to the Appleby Avenue 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 Appleby Avenue Firehouse billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the furnace units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. Some of the cap payments are excluded from the following chart.

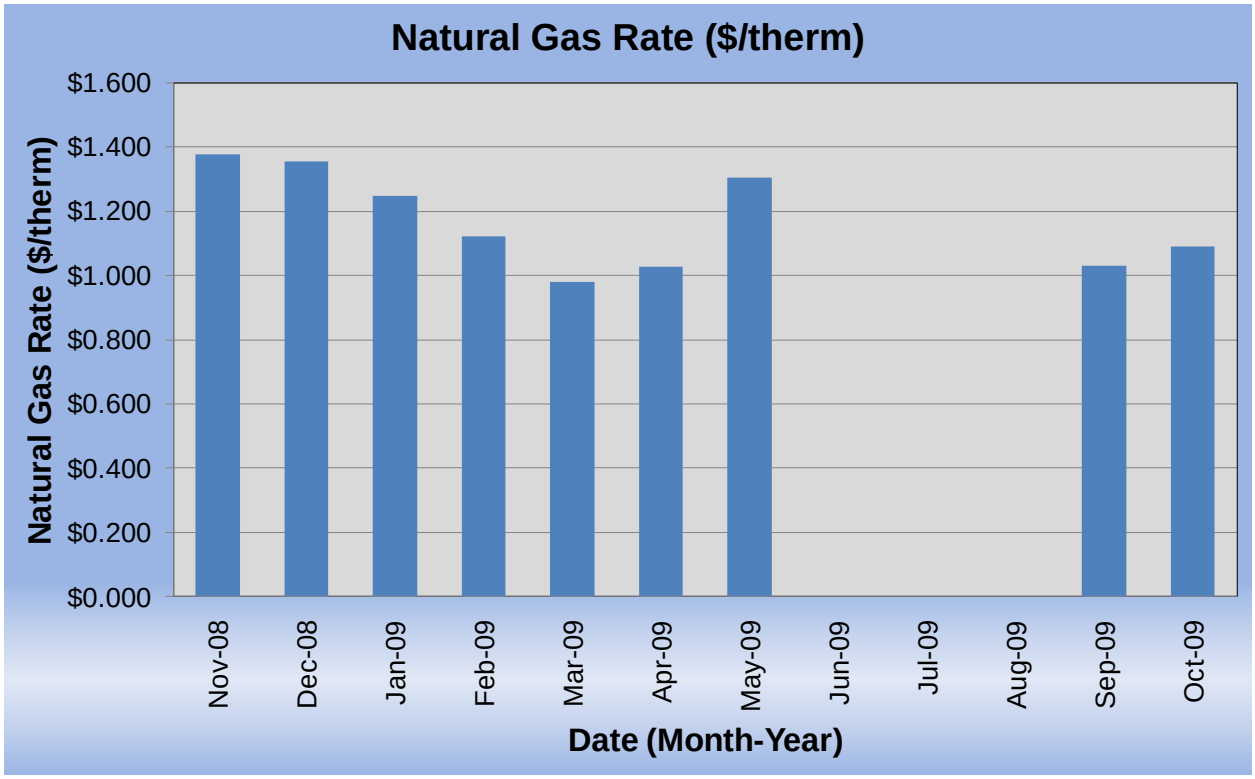


The Appleby Avenue Firehouse is direct-metered and currently purchases electricity from the South River Electric Utility at a general service rate. The general service rate for electric charges is market-rate based on use and the Appleby Avenue Firehouse does not track a breakdown of demand costs. Demand 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 for air conditioning.

6.3. Energy Procurement Strategies

The Appleby Avenue 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 Appleby Avenue Firehouse from South River Electricity Company without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric rates were estimated by the Borough of South River over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 15% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and recent escalating energy costs. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Appleby Avenue Firehouse annual utility costs are competitive when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of South River further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Appleby Avenue Firehouse. Appendix B contains a complete list of third party energy suppliers for the Borough of South River service area. The Borough of South River may want to consider partnering with other school districts, municipalities, boroughs and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. Also, the Appleby Avenue Firehouse would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. The following chart show the Appleby Avenue Firehouse monthly natural gas spending per unit of energy in 2009. Electric rates were estimated by the Borough at a constant rate of $0.130/kWh.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions, E-Quest
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published & established specialized equipment material & labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

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	Office	Parabolic	M	4'T12	2	2	40	S	4	365	15	190	277	T8	Parabolic	4'T8	E	S	2	2	32	4	365	6	140	204	73	0	73
2	1	Bathroom	Screw-in	N	Inc	4	1	60	S	4	365	0	240	350	CFL	Screw-in	CFL	N	S	4	1	20	4	365	0	80	117	234	0	234
3	1	Garage Bay	Parabolic	M	4'T12	8	2	40	S	4	365	15	760	1,110	T8	Parabolic	4'T8	E	S	8	2	32	4	365	6	560	818	292	0	292
4	1	Garage Bay	Parabolic	M	4'T12	2	4	40	S	4	365	24	368	537	T8	Parabolic	4'T8	E	S	2	4	32	4	365	13	282	412	126	0	126
5	1	Bathroom	Screw-in	N	Inc	2	1	60	S	4	365	0	120	175	CFL	Screw-in	CFL	N	S	2	1	20	4	365	0	40	58	117	0	117
6	1	Vestibule	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
7	1	Vestibule	Parabolic	M	4'T12	1	4	40	S	24	365	24	184	1,612	T8	Parabolic	4'T8	E	S	1	4	32	24	365	13	141	1235	377	0	377
8	1	Office	2'U-shape	M	4'T12	4	2	40	S	4	365	15	380	555	T8	2'U-Shape	4'T8	E	S	4	2	32	4	365	6	280	409	146	0	146
9	1	Garage Bay #2	Parabolic	M	4'T12	4	4	40	S	4	365	24	736	1,075	T8	Parabolic	4'T8	E	S	4	4	32	4	365	13	564	823	251	0	251
10	1	Garage Bay #2	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
11	1	Storage Rm	Screw-in	N	Inc	1	1	60	N	2	365	0	60	44	CFL	Screw-in	CFL	N	N	1	1	20	2	365	0	20	15	29	0	29
12	1	Meeting Rm	Recessed	M	4'T12	4	4	40	S	4	365	24	736	1,075	T8	Recessed	4'T8	E	S	4	4	32	4	365	13	564	823	251	0	251
13	1	Office	Recessed	M	4'T12	1	4	40	S	4	365	24	184	269	T8	Recessed	4'T8	E	S	1	4	32	4	365	13	141	206	63	0	63
14	1	Storage Rm	Recessed	M	4'T12	2	4	40	S	2	365	24	368	269	T8	Recessed	4'T8	E	S	2	4	32	2	365	13	282	206	63	0	63
15	1	Storage Rm	Screw-in	N	Inc	1	1	60	S	2	365	0	60	44	CFL	Screw-in	CFL	N	S	1	1	20	2	365	0	20	15	29	0	29
16	1	Storage Rm	Screw-in	N	Inc	1	1	60	S	2	365	0	60	44	CFL	Screw-in	CFL	N	S	1	1	20	2	365	0	20	15	29	0	29
17	1	Meeting Rm	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
18	Ext	Exterior	Exterior	N	CFL	7	1	13	T	12	365	0	91	399	N/A	Exterior	CFL	N	T	7	1	13	12	365	0	91	399	0	0	0
19	Ext	Exterior	Exterior	N	Inc	1	1	60	T	12	365	0	60	263	CFL	Exterior	CFL	N	T	1	1	20	12	365	0	20	88	175	0	175
20	Ext	Exterior	Exterior	N	Hal	8	1	90	T	12	365	23	904	3,960	CFL	Exterior	CFL	N	T	8	1	30	12	365	0	240	1051	2908	0	2908
21	Ext	Exterior	Exterior	N	MH	4	2	75	MS	12	365	38	752	3,294	CFL	Exterior	CFL	N	MS	4	2	25	12	365	0	200	876	2418	0	2418
Totals:						**60**	**43**	**913**				**253**	**6,271**	**15,507**						**60**	**43**	**491**			**99**	**3,703**	**7,926**	**7,580**	**0**	**7,580**

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

TO USERS: ONCE ALL ROOMS ARE ADDED, DELETE ROWS NOT USED. MAKE SURE TO DELETE ENTIRE ROW, DO NOT SHIFT CELLS!

Legend:

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

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

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

Appendix C

Glossary and Method of Calculations

Glossary of ECM Terms

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

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

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

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

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

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

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

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

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

Calculation References

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

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

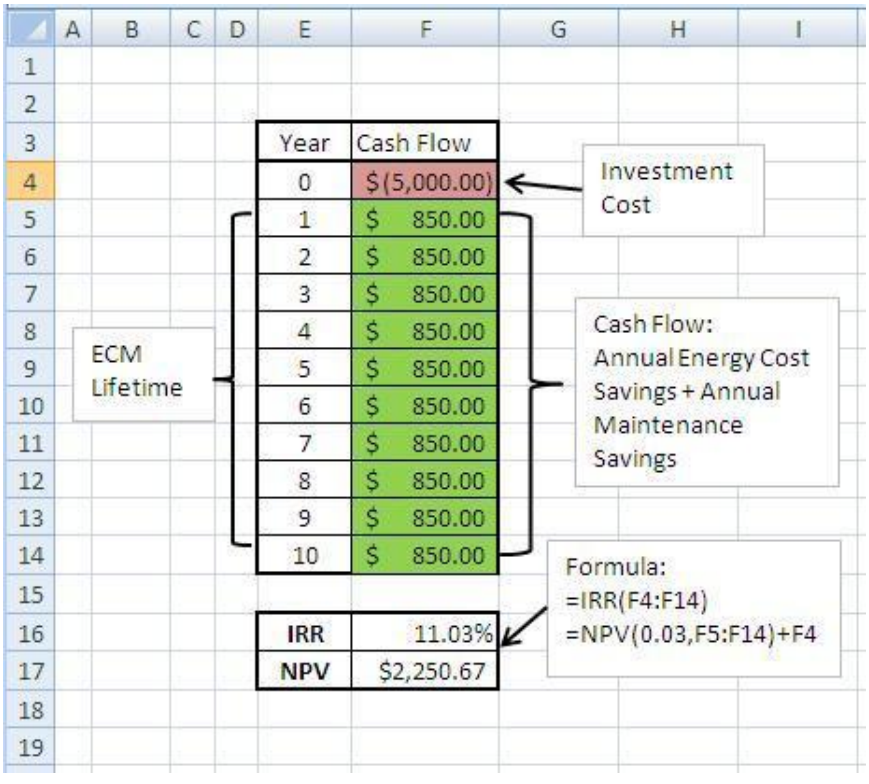
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

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

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

Excel NPV and IRR Calculation

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



ECM and Equipment Lifetimes

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

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

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

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NJCEP C & I Lifetimes

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