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**Local Government Energy Program
Energy Audit Report
FINAL**

***City of Rahway
Main Street
Rahway, NJ 07065***

Project Number: LGEA10



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INTRODUCTION

On August 11th, 12th and 13th of 2009, Steven Winter Associates, Inc. (SWA) performed an energy audit and conditions assessment of the City of Rahway buildings. The audit included a review of the:

- City Hall
- Recreation Center
- Arts Guild
- Senior Center
- Senior Center Annex
- Main Street Fire House
- Auxiliary (Maple Avenue)
- Department of Public Works

The buildings are located in Union County, NJ. This assessment was conducted under the New Jersey Clean Energy Local Government Energy Audit Program. A separate report will be submitted for each building that was assessed. This report applies only to the Fire House located at 1300 Main Street, Rahway, NJ 07065.

The Main Street Fire House is a 12,296 square foot two-story building with a full garage, dormitory, hose tower and offices, built in 1974. The garage is a one story structure while the attached office section is two stories. The administrative offices are occupied weekdays from 8:30am to 4:30pm, while the remainder of the building is utilized 24 hours per day, 7 days a week. Existing conditions and energy-related information, in addition to copies of past utility bills, were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

Existing conditions and energy-related information, in addition to copies of past utility bills, were collected in order to analyze and facilitate the implementation of energy conservation measures for the building. The goal of this energy audit is to provide sufficient information to the City of Rahway to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building. SWA also completed the Carbon Footprint Assessment for the Arts Guild building which is presented in Appendix D. SWA provides a separate addendum to this report to the City of Rahway called "Guidelines for Operating Existing Buildings" according to the Leadership in Energy and Environmental Design (LEED) program instituted by USGBC.

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 (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The document contains the energy audit report and conditions assessment report for the Fire Department headquarters building located at 1300 Main Street. The building is partially two stories, with the vehicle and maintenance garage section of only one story, with conditioned floor area of 12,296 square feet. It was built in 1974.

Based on the inspections performed by Steven Winter Associates (SWA) staff from August 11th through August 13th, 2009, 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 and conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling and electric usage.

From March 2008 to February 2009, the Main Street Firehouse building consumed 126,270 kilowatt hours (kWh) of electricity at a cost of approximately \$20,504 and 8,851 therms of natural gas at a total cost of approximately \$14,570. Combined energy consumption (electricity and gas) for that period was 1,316 million Btu (MMBtu) at a total 12-month cost of \$35,075.

SWA has entered energy information about the Main Street Fire House building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. SWA entered this building type as Fire Station/Police Station to calculate the building performance benchmark. The Portfolio Manager system does not provide an Energy Star score for Fire or Police station type buildings; however it provides a kBtu/ft²yr number for this building, and also compares this number with a national average number of similar buildings. SWA encourages the City of Rahway to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time to review the building's performance. SWA also completed the Carbon Footprint Assessment for the Arts Guild building which is presented in Appendix D.

The Site Energy Use Intensity is 104kBtu/ft²yr compared to the national average of mixed use buildings consuming 78kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 24.6kBtu/ft²yr, which when implemented would make the building energy consumption more comparable to the national average similar buildings.

Based on the assessment of the Main Street Fire House building, 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 (5) hot water unit heaters in garage
- Replace (3) exhaust fans on roof

Category II Recommendations: Operations and Maintenance

- Maintain boiler room and building piping insulation
- Maintain exterior wall brick veneer, re-pointing as necessary
- Maintain and perform regular maintenance on EPDM roof membrane and all gutters and downspouts

- Replace and maintain weather stripping on all exterior doors and garage doors
- Air seal building
- Use Energy Star labeled appliances
- Use smart power electric strips
- Install water efficient aerators, automatic timers or controls to save energy and water
- Maintain and inspect all windows for deteriorating weather-stripping or caulking

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

At this time, SWA highly recommends a total of **3** Energy Conservation Measures (ECMs) for the Main Street Fire House building that are summarized in Table 1. The total investment cost for these ECMs with incentives is **\$17,624**. SWA estimates a first year savings of **\$4,565** with a simple payback of **3.9 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Main Street Fire House building by **10,849 lbs of CO₂**, which is equivalent to removing approximately 1 cars from the roads each year or avoiding the need of 26 trees to absorb the annual CO₂ generated. SWA also recommends **3** ECMs with a total first year savings of **\$9,693** that are summarized in Table 2. SWA recommends **2** End of Life Cycle Energy Conservation Measures with a total first year savings of **\$1,442** listed in Table 3.

The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The Main Street Fire House building annual utility costs are \$1,564 higher for electric and \$850 higher for natural gas for a total of \$2,414 higher, when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield even better results.

There are various incentives the City of Rahway could apply for that would help lower the cost of installing the ECMs; these incentives are built in the savings shown in the tables that follow. More details can be found in Appendix C. SWA recommends that the City of Rahway apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. SWA also recommends that the City of Rahway apply for the NJ Direct Install program for measures recommended in Section four by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.
 Direct Install Administrator
 Phone: 610-789-1900
 Email: NJDirectInstall@TSLE.com

Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive that would pay \$5,000 for the installation of a 5kW photovoltaic system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. Renewable energy measures 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 a PV system through a loan issued by PSE&G. The City of Rahway should check with PSE&G if they offer similar rebates and help for renewable energy measures.

The following 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 or 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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
1.2	1 New CFL fixtures to be installed with incentives	RS Means, lit search	54	none at this time	54	285	0.1	0	0.1	5	51	5	233	1.1	377	75	94	455	390
1.4	11 New occupancy sensors to be installed with incentives	RS Means, lit search	2,420	220	2,200	3,792	0.8	0	1.1	0	614	15	7,228	3.6	229	15	26	3,914	5,195
2	retro commissioning	similar projects	15,370	none at this time	15,370	3,843	0.9	885	8.3	1,820	3,899	12	24,953	3.9	204	17	23	23,445	5,265
TOTALS			17,844	220	17,624	7,919	1.7	885	9.4	1,825	4,565	-	32,414	3.9	-	-	-	27,815	10,849

Assumptions: Discount Rate: 3% 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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
1.1	153 New T8 fixtures to be installed with incentives	RS Means, lit search	32,784	4,590	28,194	25,979	5.4	0	7.2	968	5,177	15	60,913	5.4	168	11	15	23,334	35,591
5	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)	similar projects	37,500	5,000	32,500	5,672	5.0	0	1.6	0	4,322	25	75,262	7.5	289	12	11	24,128	7,771
1.3	2 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	1,611	50	1,561	876	0.2	0	0.2	52	194	15	2,286	8.0	97	6	7	374	1,200
TOTALS			71,894	9,640	62,254	32,527	10.6	0	9.0	1,020	9,693	-	138,462	6.4	-	-	-	47,836	44,561

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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
4	replace hot water boiler with a condensing boiler	RS Means	10,000	300	9,700	0	0.0	753	6.1	175	1,415	20	24,805	6.9	192	10	10	4,387	0
3	replace (2) 2 HP hot water motor with premium efficiency motor	similar projects, DOE Motor Master + International	1,190	110	1,080	168	0.0	0	0.0	0	27	20	544	39.7	-50	-2	-6	-675	230
TOTALS			11,190	410	10,780	168	0.0	0	6.2	175	1,442	-	25,349	7.5	-	-	-	3,712	230

Note: For more details on End of Life Cycle ECMs and associated incremental cost for high efficiency equipment and performance see Section 4.

1. HISTORIC ENERGY CONSUMPTION

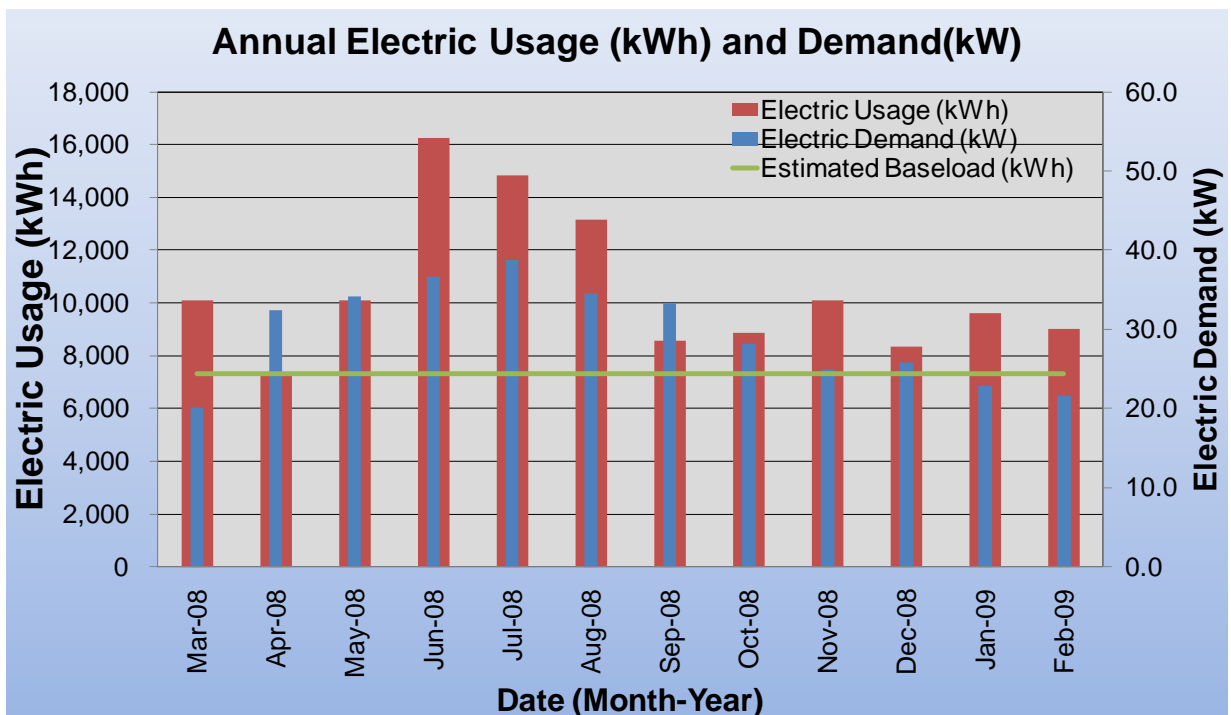
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through February 2009 that were received from the utility companies supplying the Main Street Fire House with electric and natural gas.

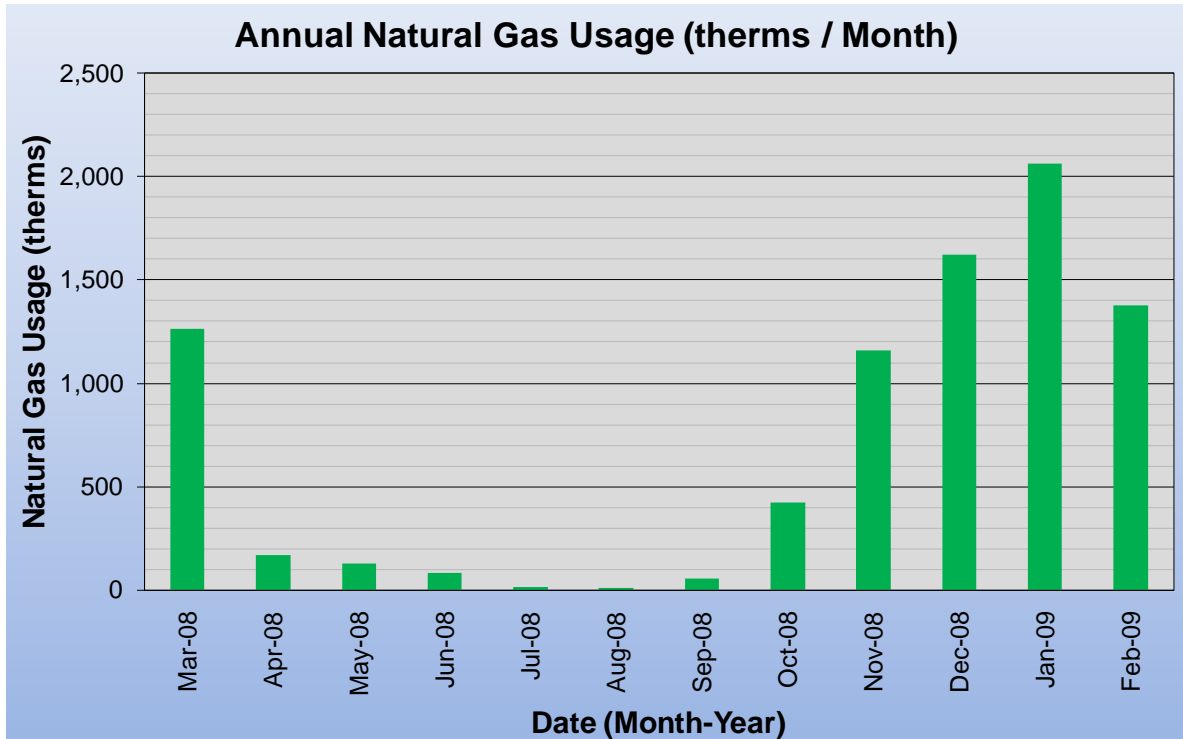
Electricity – The City of Rahway purchases electricity from PSE&G at an average rate of **\$0.162 per kWh** based on the 12 months of utility bills from March 2008 through February 2009. The Main Street Fire House used approximately **126,270 kWh or \$20,504 worth of electricity**. The data also reflected that demand averaged 29 kilowatts with a peak demand of 38.7 kW.

Natural Gas – The Main Street Fire House uses natural gas purchased from AMG, a division of Pepco Energy Services Co. and purchases the transport of the gas from Elizabethtown Gas. There are two accounts – one for domestic hot water and another for building heating. **The combined average rate for natural gas was \$1.64/therm** based on the 12 months of utility bills from March 2008 through February 2009. The building used **8,851 therms combined or total of \$14,570 worth of natural gas in a year**.

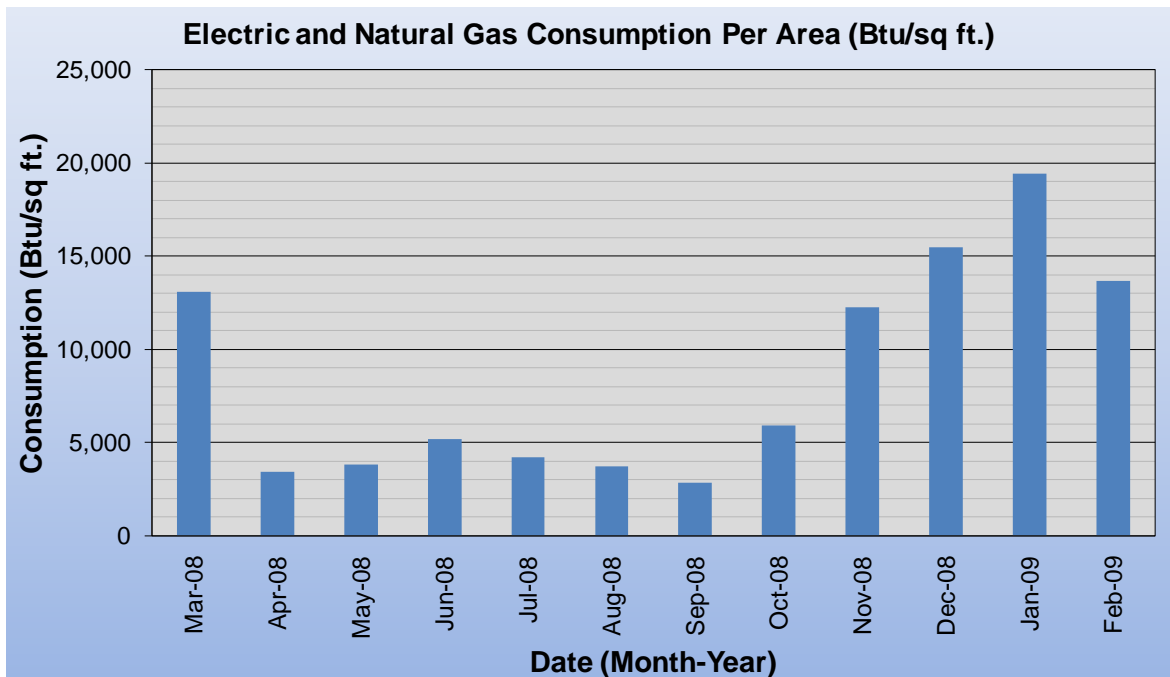
The following chart shows electricity use for the Main Street Fire House building based on utility bills for the 12 month period of March 2008 to February 2009.



The following chart shows the natural gas usage for the Main Street Fire House based on utility bills for the period starting March 2008 through February 2009.

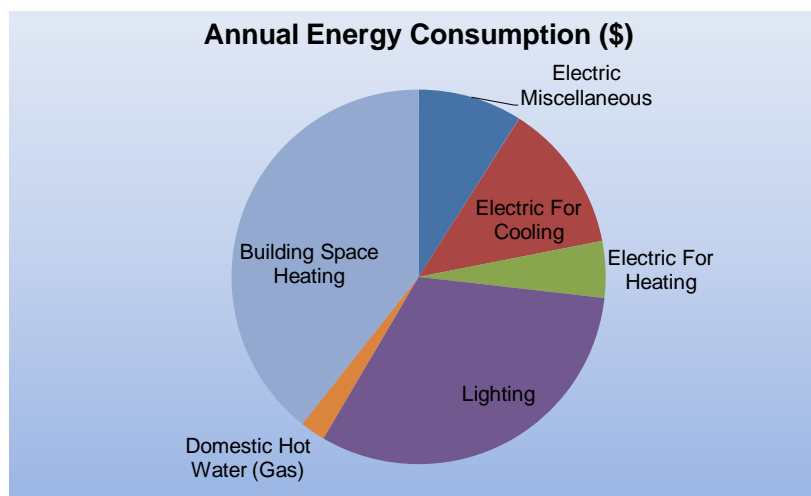
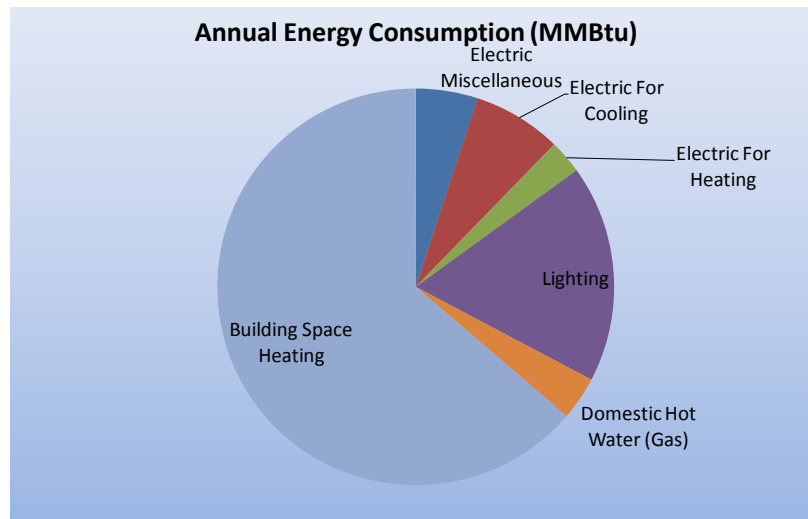


The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Main Street Fire House based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie charts show energy use for the Main St Fire House based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at \$48/MMBtu of energy is 3 times as expensive to use as natural gas at \$16/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	13	1%	\$610	2%	48
Electric For Cooling	48	4%	\$2,263	6%	48
Electric For Heating	18	1%	\$857	2%	48
Lighting	352	27%	\$16,775	48%	48
Domestic Hot Water (Gas)	46	4%	\$763	2%	16
Building Space Heating	839	64%	\$13,806	39%	16
Totals	1,316	100%	\$35,075	100%	27
Total Electric Usage	431	33%	\$20,505	58%	48
Total Gas Usage	885	67%	\$14,570	42%	16
Totals	1,316	100%	\$35,075	100%	27



1.2. Utility rate

The building purchases electricity from PSE&G. The Main Street Fire House uses Account # 07 51 317 069 12 at service address 1300 Main St, Rahway, NJ 07065. Natural Gas service is provided by Elizabethtown Gas, account number 2560865270 for heating and 5851465270 for domestic hot water. The gas itself is purchased from AMG, a division of Pepco Energy Services Co. Electricity was billed at an average aggregated rate of **\$0.162/kWh** and natural gas was billed at an average aggregated rate of **\$1.64/therm**.

1.3. Energy benchmarking

The building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. SWA has created a Portfolio Manager account for Rahway at the link below. SWA has shared the City of Rahway benchmarking profile that was developed for this report and it can be utilized as a benchmarking tool to add future data and track energy performance. A summary report of the Portfolio Manager results is provided on the following page. A rating score cannot be calculated at this time as Portfolio Manager cannot create a rating score for this type of building.

The Site Energy Use Intensity is 104 kBtu/ft²yr compared to the national average of a Fire/Police Station type building consuming 78 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 24.6 kBtu/ft²yr, which when implemented would make the building much more in line with the national average of similar buildings.

SWA has created a Portfolio Manager account for the City of Rahway to access the information. This information can be accessed at: <https://www.energystar.gov/istar/pmpam/>

Username:RahwayTownship
Password: RAHWAYNJ

SWA is also sharing the Portfolio Manager information with TRC Energy Services.



STATEMENT OF ENERGY PERFORMANCE

City of Rahway - Fire Station

Building ID: 1844664

For 12-month Period Ending: February 28, 2009¹

Date SEP becomes ineligible: N/A

Date SEP Generated: December 22, 2009

Facility City of Rahway - Fire Station 1300 Main Station Rahway, NJ 07065	Facility Owner N/A	Primary Contact for this Facility N/A
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Year Built: 1974
Gross Floor Area (ft²): 12,296

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	441,063
Natural Gas (kBtu) ⁴	840,221
Total Energy (kBtu)	1,281,284

Energy Intensity⁵

Site (kBtu/ft ² /yr)	104
Source (kBtu/ft ² /yr)	191

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	112
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Electric Distribution Utility

Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	22%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional
N/A

Notes:

- 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.
- 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.
- Values represent energy consumption, annualized to a 12-month period.
- 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.
- Values represent energy intensity, annualized to a 12-month period.
- Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Rahway Main Fire Headquarters was built in 1974. It is a 12,296 square foot two-story building with a full garage, dormitory, hose tower and offices. The main exterior surface of the building is red masonry brick and a gray sloped built-up roof. The building is both a firehouse and the administrative headquarters for the Rahway City Fire Department. The administrative offices are open from Monday to Friday 8:30 AM to 4:30 PM; meanwhile the remainder of the building is used 24 hours a day, every day of the week.

2.2. Building occupancy profiles

There are a minimum of 12 firefighter employees present at all times. Due to the nature of the building's use and occupancy, the number of people using the building at any given time is subject to fluctuations especially because of the large amount of school class visits the facility. However, it rarely reaches maximum occupancy limits.

The administrative offices are open from Monday to Friday 8:30 AM to 4:30 PM; meanwhile the remainder of the building is used 24 hours a day, 365 days per year.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls of the buildings have two typical finishes throughout the building. The first and more common surface is a layer of red masonry bricks. At these locations the exterior wall is composed of a 4" layer of red masonry bricks with a 1" layer of rigid insulation and 8" layer of concrete filled concrete masonry unit block wall to its interior.



Typical exterior surface at the firehouse

Exterior wall insulation levels could not be visually verified as there wasn't any existing access to the insulation layer.

2.3.2. Roof

The roof of the Fire House is a grey built up roof that is split into two levels, one above the garage portion of the headquarters and one above the office and dormitory portion. The roof is

generally in good condition for its age, however, there are some signs of pooling on both roofs especially on the lower roof above the garage. The roof is constructed of a 6' concrete roof slab with steel beam reinforcement and 4" of lightweight concrete deck fill interspersed with layers of bitumen and roofing membrane.



Built-up roof section above the garage showing signs pooling

No problems were observed or reported to SWA during their audit, and there are no improvements to the roof assembly or insulation that would provide a significant improvement to the building performance.

2.3.3. Base

The building's base is 6" concrete slab-on-grade with welded wire fabric reinforcement and a vapor barrier that rests above separate six inch layers of porous and compact concrete fill. There were no reported problems with water penetration or moisture. There is 1" inch of rigid board insulation at the interior of the foundation walls. This is standard for this type of structure. SWA does not recommend any additional insulation as it would not be cost effective.

2.3.4. Windows

The existing windows are aluminum frame and double-glazed with an air gap and reflective low-e coating. Most of the window units are primarily four combined push-out awning windows. However, there are some fixed units at the main entrance and small windows in some of the garage doors. They seem to be in excellent age appropriate condition.



Typical existing windows

As a best practice, SWA recommends that all windows be inspected at least once a year. Any gaps, cracks, or damage to weather-stripping or caulking should be repaired or replaced, as needed, to minimize energy loss around those openings. The building staff should also verify that windows open and close properly and repair, as needed.

2.3.5.Exterior doors

There are three typical exterior doors installed in this building. The main entrance doors are aluminum framed glass doors with two layers of glazing. There are also aluminum framed hollow core metal exit doors and aluminum paneled overhang doors with small window openings for the garage bays. The main entrance door shows signs of deteriorating weather-stripping.



Example of air gap and missing weather-stripping at entry door

As a best practice, SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. This will help optimize comfort and energy performance.

2.3.6.Building air tightness

Based on a visual inspection, the building was observed to be relatively well-sealed considering the age and intended use of the building, with the exception weather-stripping of exterior doors. In addition to the above mentioned recommendations SWA suggests air sealing, caulking and/

or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes, window or sleeve air conditioner units. The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost.

2.4. HVAC systems

2.4.1. Heating

The Firehouse is heated by an old Cyclotherm Steam Generator Co. Scotch Marine hydronic boiler (the “steam” is part of the brand name only). The boiler was installed in 1976 as an oil burning system. It was converted to a natural gas system sometime around 1984. It serves three zones: the first floor baseboard radiators, the second floor baseboard radiators and the ceiling mounted fan coil units in the garage/apparatus room as well as a heating coil in the rooftop air conditioning system. The boiler is located in the mechanical room on the first floor.

The boiler is old and it is an older technology estimated around 70% efficient with much of the heat produced wasted up the stack. Newer technology condensing boilers have several layers of heat exchange and transfer so much heat to the heating water that the flue gases are cool enough so that they can be vented through the wall in PVC pipe without need for a conventional chimney.

As the building is occupied and heated for 24 hours a day throughout the heating season, using a condensing boiler with a rated combustion efficiency of more than 90% would reduce gas use significantly. SWA is recommending replacing the boiler with a new condensing boiler



Gas-fired boiler

The heating water is circulated to the building zones by three B&G pumps with 2-horsepower motors, assumed to be original equipment. They are standard efficiency motors; SWA is recommending that they be replaced with premium efficiency motors.

Hot water is distributed to hot water unit heaters located in the garage. These unit heaters are original and past their estimated service life. SWA recommends replacement of these (5) unit heaters with new hot water unit heaters. The energy savings will not be significant and hence SWA recommends this option under the capital improvements sections.

2.4.2. Cooling

Cooling for the Firehouse is provided by a 24-ton Carrier 2-stage package system located on the roof. The cooling system was installed in 1999 to replace a system that building staff says was significantly oversized. Although the system is relatively new, the rated energy efficiency ratio (EER) is only around 8.7 to 9.2 (load efficiency due to 2 stage operation). Newer high efficiency systems can have an EER of above 12. Because the system has so much useful life remaining, SWA does not recommend replacing it now. When it does need to be replaced, the highest efficiency unit available at the time should be installed. It is worth the extra initial investment because the building is occupied 24 hours a day so the cooling is needed for many more hours than in most other municipal buildings.

2.4.3. Ventilation

Forced ventilation is provided by the air handling equipment on the roof that distributes heated or cooled air to the different parts of the building. There are also some rooftop exhaust fans serving the kitchen and rest rooms. The garage is naturally ventilated.

2.4.4. Domestic Hot Water

The domestic hot water is supplied by a relatively new (2008) Rheem combination water heater / storage system with a water heating capacity of about 38,000 Btu per hour (Btuh) and a 50 gallon storage tank. The system burns natural gas. It has a rated Energy Factor (EF) of .58. Energy factor is a rating system developed by the U.S. Department of Energy and takes into account:

- Recovery Efficiency: How efficiently is the heat transferred to the water
- Standby Loss: The percentage of heat loss per hour of the stored hot water
- Cycling Loss: The loss of heat as the water is cycled and recycled through the unit

The energy factor for natural gas water heaters can be as low as .5 and as high as around .67 (the higher the EF the better). This heater is right in the middle of the range.

2.5. Electrical systems

2.5.1. Lighting

In accordance with requirements of the Local Government Energy Audit program, SWA, Inc. performed an investment grade lighting audit, which provides a comprehensive survey of existing lighting, and an extensive technical and financial analysis.

Interior Lighting – Most of the lighting is comprised of older T12 lamps with magnetic ballasts. SWA recommends replacing these fixtures with T8 lamp fixtures with electronic ballasts which are far more efficient. SWA recommends the replacement of all halogen and incandescent bulbs with energy efficient compact fluorescents. Compact Fluorescents (CFLs) utilize a fraction of the wattage of halogens or incandescent to produce the equivalent lumens. The bulbs also have a lifetime of approximately 8-10,000 hours, reducing labor costs replacing bulbs.

Exterior Lighting - The exterior lighting surveyed during the building audit included one incandescent fixture and two Metal Halide fixtures. SWA recommends replacement of the

Metal halide bulb with a pulse start metal halide and the incandescent bulb with a compact fluorescent bulb.

SWA also recommends installing occupancy sensors in bathrooms, closets, offices and areas that are occupied only part of the day. Typically, occupancy sensors have an adjustable time delay that turns off the lights automatically if no motion or sound is detected within a set time period. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

2.5.2. Appliances and process

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

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions (DVDs, stereos, computers, and kitchen appliances which now have internal memories or clocks which always require a trickle of power) use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. 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 Main Street Fire House does not have any elevators.

2.5.4. Other electrical systems

There are currently no any other significant energy impacting electrical systems installed at the Main Street Fire House building.

3. EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Hot water boiler - originally oil fired, converted to gas in 1984; 208V, 10.6Amps; Capacity n/a; c/w 3 1/4hp B&G circulators; est. efficiency 80%	Mechanical room	Cyclotherm Steam Generator co; S/N 874915	Gas	Whole building	1976	0%
Heating	Hot water pumps; 2hp, 220V, 7.7 amps motors	Mechanical room	Nameplate N/A	Elec.	Roof units	1980's	0%
H/V	Hot water heating AHU for ventilation; capacity n/a; Unit not in use	On roof	Nameplate N/A	Elec.	Whole building	1976	0%
Cooling	Package DX unit, 24 ton cooling, R-22, 208/230V, 31.6FLA; 2 stage	Roof	Carrier, model 50TJ-024-57OQA; S/N 2399F25392	Elec.	Fire house, except garage	1999	35%
Heating	Hot water unit heaters, (5)	Vehicle garage	Nameplate N/A	Elec.	Garage	1975	0%
Ventilation	Bathroom exhaust fan	Roof	Greenheck, model LBE10, s/n 327454	Elec.	Bathroom	1976	0%
Ventilation	Shower exhaust fan	Roof	Greenheck, model LBE10, s/n 327455	Elec.	Showers	1976	0%
Ventilation	Kitchen exhaust fan	Roof	Greenheck, model LBE10, s/n 327456	Elec.	Kitchen	1976	0%
DHW	Domestic hot water tank, 38MBH, 50 Gallons storage; est. efficiency 82%	Mechanical room	Rheem, Model 22V50F1, S/N RHLN0808A20068	Gas	Whole building	2008	90%

4. ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA has separated the investment opportunities into three categories of recommendations:

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

Category I Recommendations: Capital Improvements

- Replace (5) hot water unit heaters in garage: These units are original and past their service life. SWA recommends replacing these units with 5 new hot water unit heaters. The energy savings will be marginal and hence this measure is listed as capital improvement. Estimated cost of replacement is approximately \$10,000.
- Replace (3) exhaust fans on roof: Bathroom, showers, and kitchen exhaust fans on roof are more than 20 years old and have lived their useful lives. SWA recommends replacing these fans to ensure smooth operation for years to come. The energy savings will be marginal and hence this measure is listed as capital improvement. The existing equipment is unreliable and may give rise to maintenance issues. The estimated cost of replacement is approximately \$9,000.

Category II Recommendations: Operations and Maintenance

- Pipe Insulation – All hot water, steam and DHW pipes should be inspected and any missing or deteriorated insulation should be replaced with new.
- Maintain exterior wall brick veneer – All exterior wall surfaces should be maintained on a regular basis, rep-pointing brickwork as necessary, to prevent water infiltrating wall assemblies.
- Maintain roofs - SWA recommends regular maintenance on all roof surfaces, sealing seams, checking for clogged downspouts, and cleaning gutters. Any damage to the roof membrane should be repaired immediately to prevent additional interior damage.
- Weather Stripping – As a best practice, exterior/overhead doors and vestibule doors should be observed annually for deficient weather-stripping and replaced as needed.
- Air Sealing - SWA suggests air sealing, caulking and/ or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes, chimney walls and window, or sleeve air conditioner units. The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost. Any other accessible gaps or penetrations in the thermal envelope should also be sealed with caulk or spray foam.
- 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.

- 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
- Maintain all windows - 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 frame. Building staff should also verify that windows open and close properly and repair, as needed.

Category III Recommendations: Energy Conservation Measures

Summary table

<i>ECM#</i>	<i>Description</i>
1	Building Lighting Upgrades
2	Retro-Commissioning
3	Install premium efficiency motors on hot water pumps
4	Install new condensing boiler
5	Install 5 Kilowatt Solar Photovoltaic System

ECM#	Table 1 - Highly Recommended 0-5 Year Payback ECMs
1.2	1 New CFL fixtures to be installed with incentives
1.4	11 New occupancy sensors to be installed with incentives
2	retro commissioning
Table 2 - Recommended 5-10 Year Payback ECMs	
1.1	153 New T8 fixtures to be installed with incentives
5	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)
1.3	2 New pulse start metal halide fixtures to be installed with incentives
Table 3 - Recommended End of Life Cycle ECMs	
4	replace hot water boiler with a condensing boiler
3	replace (2) 2 HP hot water motor with premium efficiency motor

ECM#1: *Building Lighting Upgrades*

Description:

On the days of the conditions assessment inspections, SWA completed a lighting inventory of the Main Street Firehouse (see Appendix A). The existing lighting consists of mostly older technology T12 fluorescent fixtures with magnetic ballasts. These should be replaced with fixtures equipped with electronic ballasts and T8 lamps. SWA also performed an evaluation of installing occupancy sensors in offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. The labor for the lighting improvement measures was estimated using local prevailing electrical contractor wages.

Installation cost:

Estimated installed cost: \$32,009 (estimated labor cost, \$18,678)

Source of cost estimate: *RS Means; Vendors*

Economics :

ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO2 reduced, lbs/yr
1.1	153 New T8 fixtures to be installed with incentives	RS Means, lit search	32,784	4,590	28,194	25,979	5.4	0	7.2	968	5,177	15	60,913	5.4	168	11	15	23,334	35,591
1.2	1 New CFL fixtures to be installed with incentives	RS Means, lit search	54	none at this time	54	285	0.1	0	0.1	5	51	5	233	1.1	377	75	94	455	390
1.3	2 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	1,611	50	1,561	876	0.2	0	0.2	52	194	15	2,286	8.0	97	6	7	374	1,200
1.4	11 New occupancy sensors to be installed with incentives	RS Means, lit search	2,420	220	2,200	3,792	0.8	0	1.1	0	614	15	7,228	3.6	229	15	26	3,914	5,195
TOTALS			36,869	4,860	32,009	30,931	6.4	0	8.6	1,026	6,036		70,661	5.3	121	-	-	28,077	42,375

Assumptions: SWA calculated the savings for this measure using best estimates and staff interviews regarding the time of lights actually on.

Rebates/financial incentives:

*NJ Clean Energy - T8 lamps with electronic ballast in existing facilities (\$10-30 per fixture, depending on quantity and lamps)
Maximum incentive amount is \$4,590.*

*NJ Clean Energy - Wall Mounted occupancy sensors (\$20 per control)
Maximum incentive amount is \$220.*

NJ Clean Energy – Pulse Start Metal Halide lamps in existing facility (\$10-14 per fixture, depending on quantity and lamps). Maximum incentive amount is \$50.

Options for funding the Lighting ECM (Please see Appendix C also):

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>

This project may benefit from enrolling in the NJ Direct Install program by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.
Direct Install Administrator
Phone: 610-789-1900
Email: NJDirectInstall@TSLE.com

<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM#2: Retro-Commissioning

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and / or address problems that have developed throughout the building’s life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

SWA recommends retro-commissioning to optimize system operation. Most systems have been operating since 1979. The retro-commissioning process should include a review of existing operational parameters for all installed equipment. During retro-commissioning, the individual loop temperatures should also be reviewed to identify opportunities for optimizing system performance.

Installation cost:

Estimated installed cost: \$15,370 (estimated labor cost of \$13,661)

Source of cost estimate: Similar projects

Economics (without 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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
2	retro commissioning	similar projects	15,370	none at this time	15,370	3,843	0.9	885	8.3	1,820	3,899	12	24,953	3.9	204	17	23	23,445	5,265

Assumptions: Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from \$0.50-\$2.00 per square foot. SWA assumed \$1.25 per square foot of a total square footage of 12,296. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates / financial incentives: *There are no direct incentives for this measure.*

Options for funding ECM (Please see Appendix C also):

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>

This project may benefit from enrolling in NJ Direct Install program by contacting the following contractor in Union County:

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<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM#3: Install Premium Efficiency Motors on Heating Pumps

Description:

The building consists of two heating pumps, one working and one stand-by. These pumps are original with old, standard efficiency motors. SWA recommends replacing the motors, which are nearing their end, with premium efficiency motors to realize maximum energy savings. The economics for replacing both motors results in a very long payback because the use hours of the pumps are limited. Both pumps have 2hp motor respectively. The financial returns in the table below have been calculated using the cost of replacing only one motor, the lead motor. The cost of replacing the lag motor is considered a capital improvement not necessarily improving energy performance from its investment.

Installation cost:

Estimated installed cost (for both motors): \$1,190 (estimated labor cost, \$350)

Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
3	replace (1) 2 HP hot water motor with premium efficiency motor	similar projects, DOE Motor Master + International	595	110	485	168	0.0	0	0.0	0	27	20	544	17.8	12	1	1	-80	230

Assumptions: SWA calculated the savings for this measure using 3000 hour estimate for the run hours per year.

Rebates/financial incentives:

*NJ Clean Energy - Premium three-phase motors (\$45-\$700 per motor)
Maximum incentive amount is \$110.*

Options for funding ECM (Please see Appendix C also):

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>

This project may benefit from enrolling in NJ Direct Install program by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.

Direct Install Administrator

Phone: 610-789-1900

Email: NJDirectInstall@TSLE.com

<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM #4: Install new condensing boiler

Description:

The existing boiler at the Main Street has been in service since 1979 and is past its service life. SWA recommends replacing the boiler, which has an estimated efficiency of only 78% to 80%.

First, SWA analyzed the replacement with a kind boiler, which is listed below in the Table as ECM#4a. Further, SWA analyzed the incremental cost and benefits of installing a condensing boiler, which have rated efficiencies above 90%. In condensing boilers there is a second heat exchanger where hot flue gasses are captured and transferred until the point at which the water vapor condenses. This process allows the condensing boiler to extract much more heat from the normal combustion process. Based on the analysis, SWA recommends replacing the existing boiler with a new condensing boiler of equivalent capacity.

Installation cost:

Estimated cost: \$10,000 (labor cost estimated, \$3,200)

Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
4a	replace hot water boiler	RS Means	7,000	300	6,700	0	0.0	251	2.0	175	588	20	8,268	11.4	76	3.8	0.82	-843	0
4b	incremental cost to replace with a condensing boiler	RS Means	3,000	0	3,000	0	0.0	502	4.1	0	827	20	16,536	3.6	451	22.6	25.81	5,230	0
4	replace hot water boiler with a condensing boiler	RS Means	10,000	300	9,700	0	0.0	753	6.1	175	1,415	20	24,805	6.9	192	9.6	9.88	4,387	0

Assumptions:

SWA calculated the savings for this measure using the billing analysis to estimate gas used only for heating and estimating the efficiency of the old boiler. Further, name plate of the existing boiler does not list the boiler capacity – SWA estimated the replacement boiler size of 300MBH based on past experience. SWA assumed an effective 90% efficiency for the new condensing boiler, and 84% for a new replacement-in-kind one.

Rebates/financial incentives:

NJ Clean Energy - Gas-fired boilers < 300 MBH (\$300 per unit)

Options for funding ECM (Please see Appendix C also):

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>

This project may benefit from enrolling in NJ Direct Install program by contacting the following contractor in Union County:

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Direct Install Administrator
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Email: NJDirectInstall@TSLE.com

<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM#5: Install 5kW PV system

Description:

Currently, the Main Street building 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. SWA presents below the economics, and recommends at this time that City of Rahway further review installing a 5kW 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. Utilities provide the ability to buy SRECs at \$600 / MWh or best market offer.

There are many possible locations for a 5kW PV installation on the building roof. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 5kW system needs approximately 41 panels which would take up 435 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: \$37,500 (estimated labor costs, \$15,000)

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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
5	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)	similar projects	37,500	5,000	32,500	5,672	5.0	0	1.6	0	4,322	25	75,262	7.5	289	12	11	24,128	7,771

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 (123 Watts, model #ND-123UJF). 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 (Please see Appendix C also):

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on \$1.00 / watt Solar PV application. Incentive amount for this application is \$5,000.

<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 1000kWh (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. \$3,000 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>

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Wind

Description:

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

5.3. Solar Photovoltaic

Please 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:

SWA considered the installation of a combined heat and power system for the Fire House but does not recommend its installation because of the HVAC equipment type and insufficient year-round thermal loads.

5.6. Geothermal

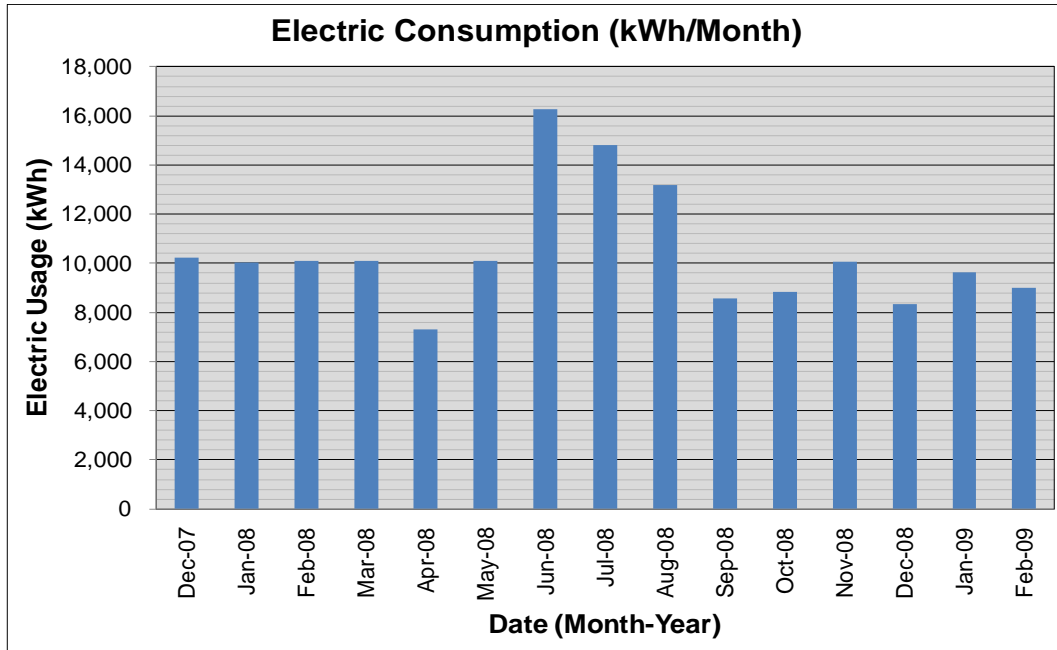
Description:

Geothermal is not applicable for this Fire House because small energy needs for the building do not justify a huge investment.

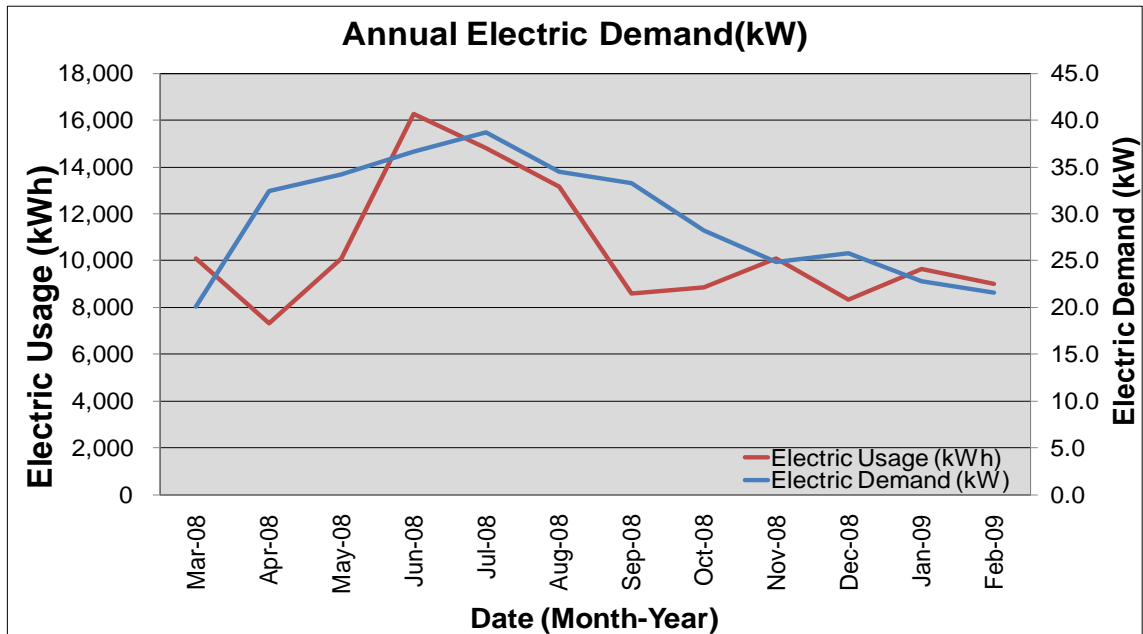
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

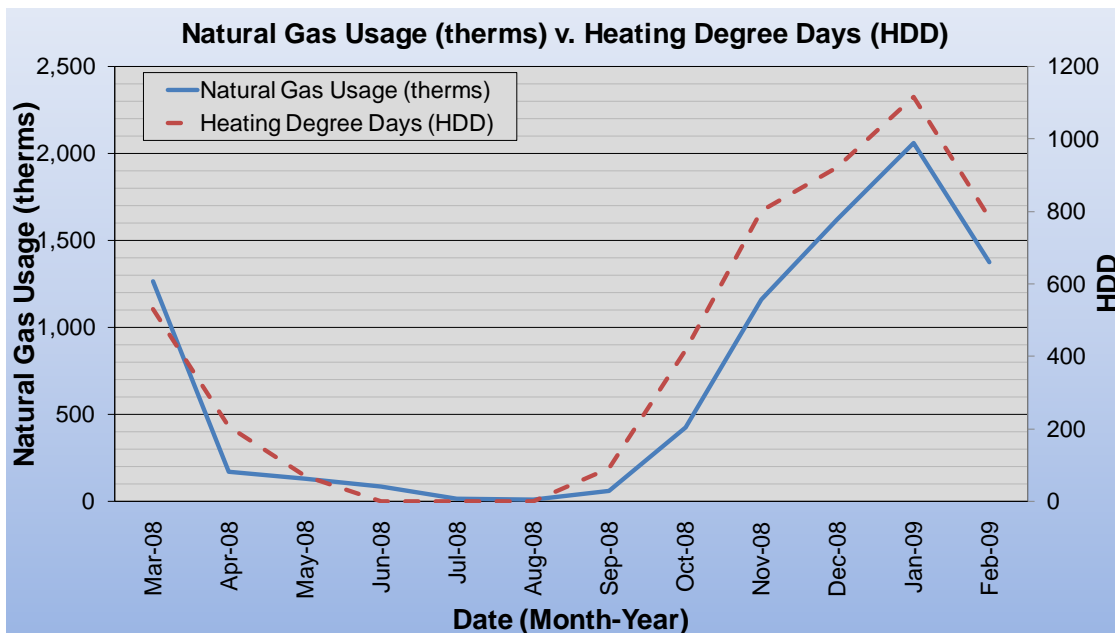
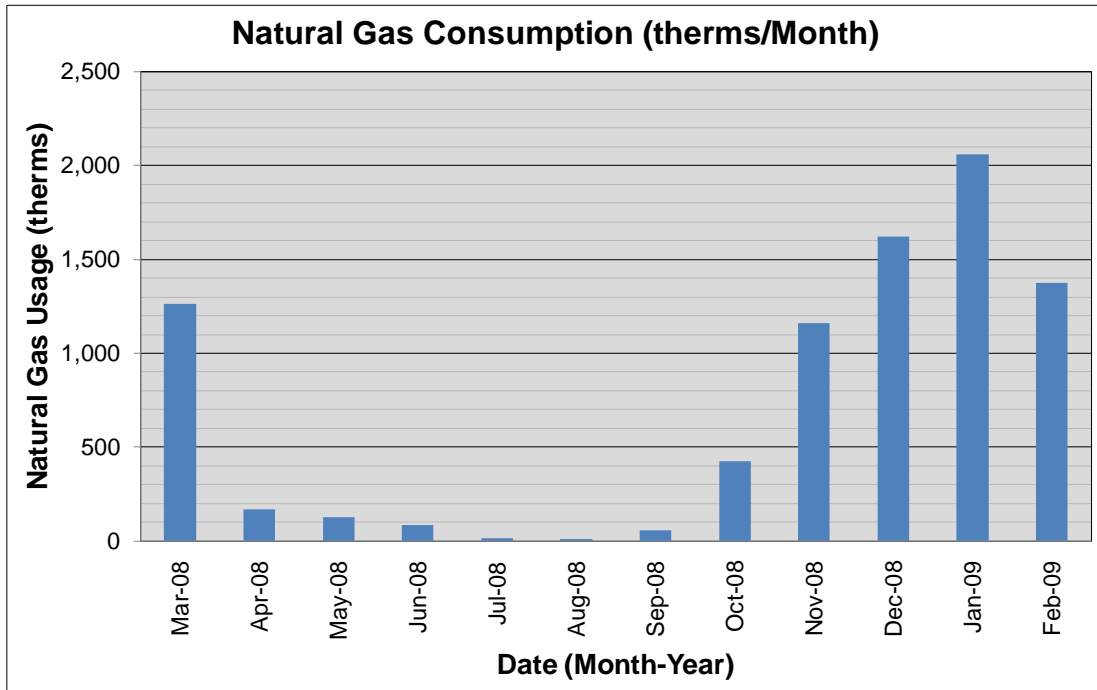
The following are charts that show the annual electric and natural gas load profiles for the Main Street Fire House.



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.



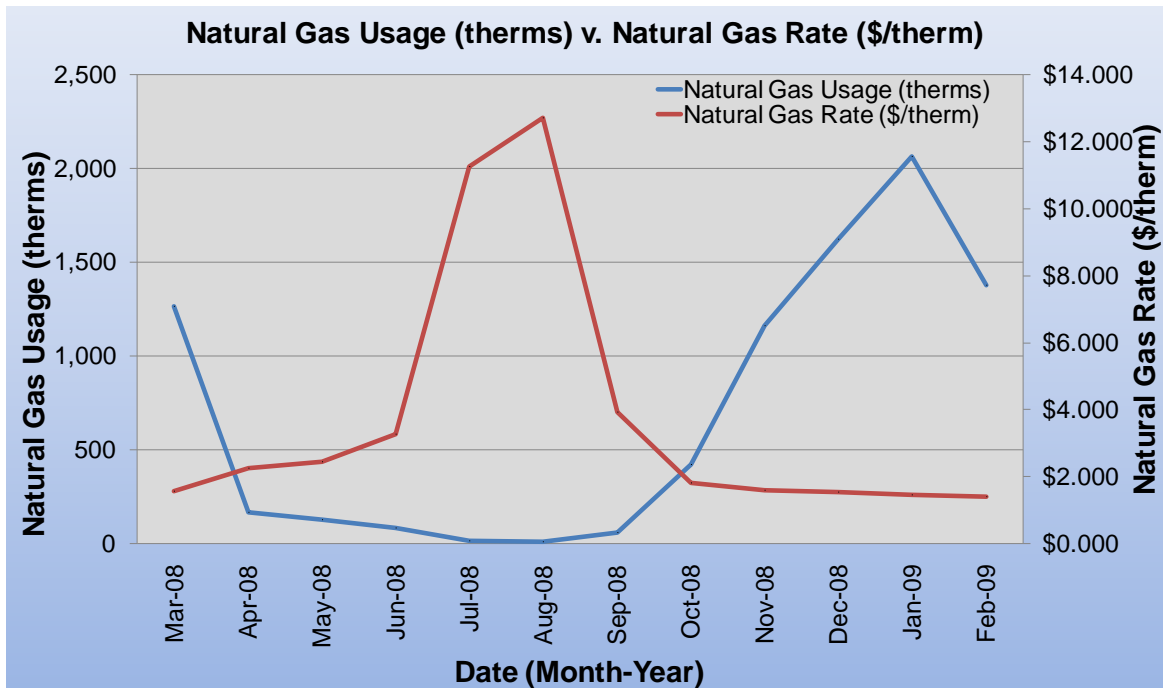
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



6.2. Tariff analysis

The City of Rahway currently buys electricity and gas from PSE&G, Pepco and Elizabethtown Gas respectively, on general service rates. The general service is a typical rate where customers pay for

natural gas based on usage and for electricity based on consumption as well as peak electrical demand. The general service rate is the best option at this time.



The Main Street Fire House building is direct-metered (via one main meter). The general service rate for electric charges are market-rate based on use and the building billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

6.3. Energy Procurement Strategies

The Main Street Fire House building receives natural gas via two incoming meters, one for hot water and other for heating service. Pepco supplies the gas and Elizabeth Town transports it. 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.

SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 36% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 89% 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 escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The Main Street Fire House building annual utility costs are \$2,414 higher for electric and \$850 higher for natural gas for a total of \$2,414 higher, when compared to the average estimated NJ commercial utility rates.

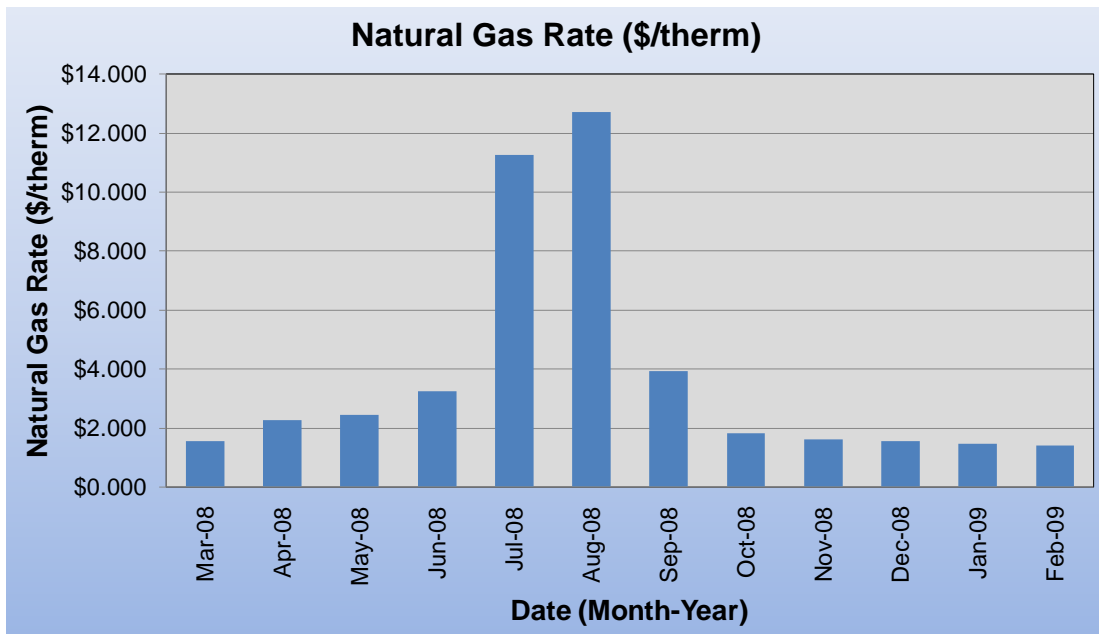
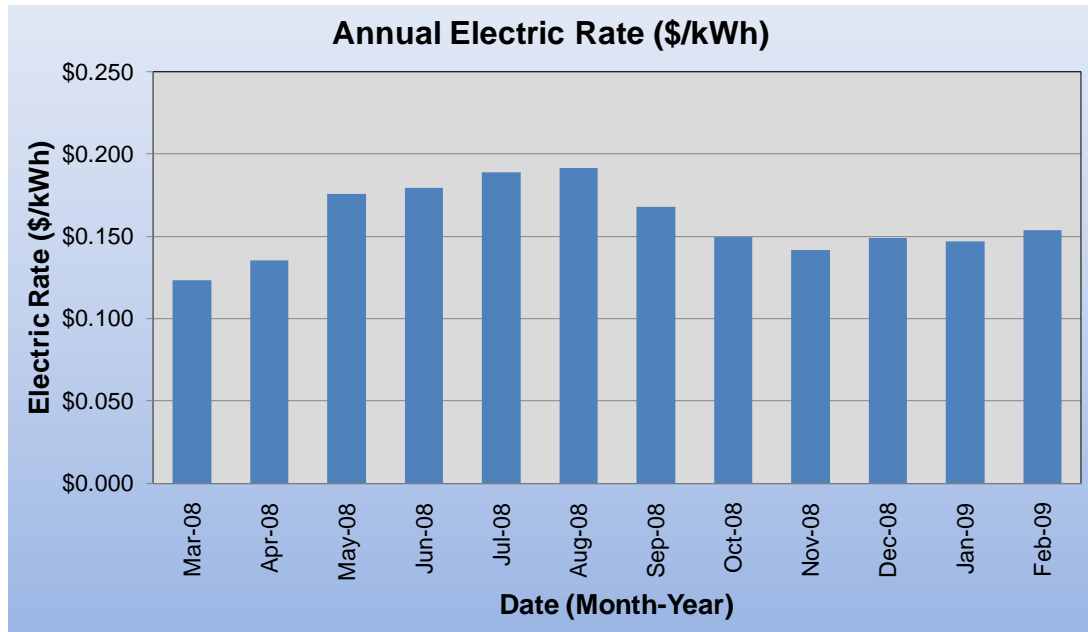
SWA recommends that the City of Rahway further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual

cost of energy for the Main Street Firehouse building. Appendix B contains a complete list of third party energy suppliers for the Rahway service area.

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

The Main Street Firehouse building 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 charts show the building monthly spending per unit of energy in 2008.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool: Established / standard industry assumptions, DOE 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 and established specialized equipment material and 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 Survey

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	Shop	Parabolic	E	4T8	4	2	32	S	8	365	6	262	818	N/A	Parabolic	4T8	E	S	4	2	32	8	365	6	262	818	0	0	0	
2	1	Day Room	Parabolic	M	4T12	4	4	40	S	8	365	24	664	2,149	T8	Parabolic	4T8	E	OS	4	4	32	6	365	13	525	1235	502	412	914	
3	1	Kitchen/Dining	Parabolic	M	4T12	3	4	40	S	8	365	24	504	1,612	T8	Parabolic	4T8	E	OS	3	4	32	6	365	13	397	926	377	309	685	
4	1	Watch	Parabolic	M	4T12	8	2	40	S	24	365	15	655	6,658	T8	Parabolic	4T8	E	S	8	2	32	24	365	6	518	4906	1752	0	1752	
5	1	Boiler Room	Parabolic	M	4T12	3	2	40	S	2	365	15	255	208	T8	Parabolic	4T8	E	S	3	2	32	2	365	6	198	153	55	0	55	
6	1	Library	Parabolic	M	4T12	4	2	40	S	8	365	15	335	1,110	T8	Parabolic	4T8	E	OS	4	2	32	6	365	6	262	613	292	204	496	
7	1	Fire Alarm Repair	Parabolic	M	4T12	5	4	40	S	8	365	24	824	2,686	T8	Parabolic	4T8	E	OS	5	4	32	6	365	13	653	1544	628	515	1142	
8	1	Control Room	Parabolic	M	4T12	4	2	40	S	24	365	15	335	3,329	T8	Parabolic	4T8	E	S	4	2	32	24	365	6	262	2453	876	0	876	
9	1	Car Garage	Parabolic	M	4T12	6	2	40	S	24	365	15	495	4,993	T8	Parabolic	4T8	E	S	6	2	32	24	365	6	390	3679	1314	0	1314	
10	1	Garage Apparatus	Parabolic	M	4T12	67	2	40	S	24	365	15	5,375	55,757	T8	Parabolic	4T8	E	S	67	2	32	24	365	6	4294	41084	14673	0	14673	
11	1	Small Bathroom	Parabolic	M	4T12	1	2	40	S	8	365	15	95	277	T8	Parabolic	4T8	E	S	1	2	32	8	365	6	70	204	73	0	73	
12	1	Corridor	Parabolic	M	4T12	4	2	40	S	24	365	15	335	3,329	T8	Parabolic	4T8	E	S	4	2	32	24	365	6	262	2453	876	0	876	
13	2	Dormitory	Parabolic	M	4T12	7	2	40	S	12	365	15	575	2,913	T8	Parabolic	4T8	E	OS	7	2	32	9	365	6	454	1610	767	537	1303	
14	2	Stairwell	Parabolic	M	4T12	1	2	40	S	24	365	15	95	832	T8	Parabolic	4T8	E	S	1	2	32	24	365	6	70	613	219	0	219	
15	2	Stairwell	2U-shape	M	2T12	1	2	24	S	24	365	16	64	561	N/A	2U-shape	2T8	N	S	1	2	24	24	365	5	53	464	96	0	96	
16	2	Chief's Office	Parabolic	M	4T12	8	2	40	S	8	365	15	655	2,219	T8	Parabolic	4T8	E	OS	8	2	32	6	365	6	518	1226	584	409	993	
17	2	Locker Room	Parabolic	M	4T12	5	2	40	S	12	365	15	415	2,081	T8	Parabolic	4T8	E	OS	5	2	32	9	365	6	326	1150	548	383	931	
18	2	Records/Storage	Parabolic	M	4T12	2	4	40	S	8	365	24	344	1,075	T8	Parabolic	4T8	E	OS	2	4	32	6	365	13	269	618	251	206	457	
19	2	Captain's Office	Parabolic	M	4T12	6	2	40	S	8	365	15	495	1,664	T8	Parabolic	4T8	E	OS	6	2	32	6	365	6	390	920	438	307	745	
20	2	Bureau of Combustibles	Parabolic	M	4T12	4	2	40	S	8	365	15	335	1,110	T8	Parabolic	4T8	E	OS	4	2	32	6	365	6	262	613	292	204	496	
21	2	Deputy's office	Parabolic	M	4T12	6	2	40	S	8	365	15	495	1,664	T8	Parabolic	4T8	E	OS	6	2	32	6	365	6	390	920	438	307	745	
22	2	Corridor	Parabolic	M	4T12	1	2	40	S	24	365	15	95	832	T8	Parabolic	4T8	E	S	1	2	32	24	365	6	70	613	219	0	219	
23	2	Corridor	2U-shape	M	2T12	4	2	24	S	24	365	16	208	2,243	T8	2U-shape	2T8	E	S	4	2	18	24	365	5	149	1437	806	0	806	
24	Ext	Exterior	Exterior	M	MH	2	1	250	S	12	365	63	563	2,742	PSMH	Exterior	PSMH	N	T	2	1	175	9	365	38	388	1399	876	466	1342	
25	Ext	Exterior	Exterior	N	INC	1	1	100	S	12	365	0	100	438	CFL	Exterior	CFL	N	T	1	1	35	9	365	0	35	115	285	38	323	
Totals:						161	56	1,230					437	14,573	103,299						161	56	924				11,467	71,767	27,236	4,296	31,532

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

Proposed Lighting Summary Table			
Total Surface Area (SF)	12,296		
Average Power Cost (\$/kWh)	0.1620		
Exterior Lighting	Existing	Proposed	Savings
Exterior Annual Consumption (kWh)	3,180	1,514	1,665
Exterior Power (watts)	663	423	240
Total Interior Lighting	Existing	Proposed	Savings
Annual Consumption (kWh)	100,119	70,252	29,866
Lighting Power (watts)	13,910	11,044	2,866
Lighting Power Density (watts/SF)	1.13	0.90	0.23
Estimated Cost of Fixture Replacement (\$)	34,449		
Estimated Cost of Controls Improvements (\$)	2,420		
Total Consumption Cost Savings (\$)	6,036		

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 (Install new T8)
Pin	1T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Recessed	3T5	PC (Photocell)		LEDex (Install new LED Exit)
2U-shape	4T5	D (Dimming)		LED (Install new LED)
Circiline	2T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
	4T8			PSMH (Install new Pulse-Start Metal Halide)
	6T8			
	8T8			
	2T12			
	3T12			
	4T12			
	6T12			
	8T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium)			
	LPS (Low Pressure Sodium)			

DISCLAIMER: LIGHTING COUNTS IN THE SPREADSHEET ABOVE ARE GOOD ONLY FOR AREAS ACCESSIBLE TO SWA AUDITORS. SWA DOES NOT ACCEPT RESPONSIBILITY FOR MISSING LIGHTS, AS SOME SPACES WERE NOT ACCESSIBLE ON THE DAYS OF FIELD VISIT. THEREFORE, THE LIGHTING COUNTS MAY NOT BE ACCURATE.

Appendix B: Third Party Suppliers (ESCOs)

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

PSE&G ELECTRICAL SERVICE TERRITORY		
Last Updated: 06/15/09		
<p>Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com</p>	<p>BOC Energy Services, Inc. 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com</p>	<p>Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com</p>
<p>Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com</p>	<p>Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com</p>	<p>FirstEnergy Solutions Corp. 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com</p>
<p>Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com</p>	<p>Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrusenergy.com</p>	<p>Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com</p>
<p>Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com</p>	<p>Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com</p>	<p>PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com</p>
<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com</p>	<p>South Jersey Energy Company One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.southjerseyenergy.com</p>	<p>Suez Energy Resources NA, Inc. 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com</p>
<p>UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com</p>	<p>American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com</p>	<p>ConEdison Solutions Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com</p>
<p>Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com</p>	<p>Sprague Energy Corp. 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com</p>	

PSE&G NATURAL GAS SERVICE TERRITORY

Last Updated: 06/15/09

<p>Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com</p>	<p>Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com</p>	<p>Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com</p>
<p>Gate way Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com</p>	<p>UGI Energy Services, Inc. d/b/a GASMAR 704 East Main Street, Suite 1 Moorestown, NJ 080113 856-273-9995 www.ugienergyservices.com</p>	<p>Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com</p>
<p>Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com</p>	<p>Hudson Energy Services, LLC 871 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com</p>	<p>Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org</p>
<p>Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com</p>	<p>Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com</p>	<p>Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601 888-113-Metro www.metroenergy.com</p>
<p>MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com</p>	<p>NATGASCO (Mitchell Supreme) 1132 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com</p>	<p>Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com</p>
<p>PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com</p>	<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com</p>	<p>South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm</p>
<p>Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011328 800-225-1560 www.spragueenergy.com</p>	<p>Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64113 www.stuyfuel.com</p>	<p>Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-5113-1121 www.woodruffenergy.com</p>

Appendix C: 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. The incentives 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's 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 80%** 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 here.

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>.

Appendix D: Carbon Footprint Assessment

At the Kyoto summit of 1997, and more recently at the 2009 Copenhagen climate conference, world leaders have officially endorsed the theory that carbon dioxide (CO₂) and other greenhouse gases have an impact on global climate change. The total set of greenhouse gas (GHG) emissions caused by an organization is known as that organization's "carbon footprint." Calculating the carbon footprint has become an integral part of any environmental performance assessment.

Increasingly, local and federal authorities are moving toward more stringent rules aimed at curbing carbon emissions from a number of institutions. Carbon dioxide (CO₂) emissions result from activities such as heating, electricity generation, transport and wastes disposals. By reducing its carbon footprint, an organization is better able to manage resources and output, reduce energy costs, and mitigate its environmental impact.

Steven Winter Associates has conducted a carbon footprint evaluation for the city of Rahway using guidance provided by the Greenhouse Gas Protocol Initiative (GGPI). GGPI is an international accounting tool that is widely used by government and business leaders to understand quantify and manage greenhouse gas emissions. The GHG protocol initiative methodology divides emissions into three scopes depending on the source of the emissions.

Because the data collected by SWA in the Rahway energy audit were limited to energy consumption, this report focuses only on building-related emissions included in scopes 1 and 2. Excluding Scope 3 emissions, the total emission for the Fire Station building was 107.08 metric tons, or 236,111 lbs of CO₂, between March 2008 to February 2009.

Scope 1 emissions constitute direct emissions resulting from the combustion of natural gas to heat the building and provide hot water. They account for 39.09 % of the building's emissions, or 41.85 metric tons.

Scope 2 emissions constitute indirect emissions from the generation and transport of purchased electricity used to power appliances, such as lighting, electronics and HVAC systems. In this case, they account for 60.91% of the building's emissions, or 65.23 metric tons.

The Fire Station building generates 9 % of the total emissions for the eight audited buildings included in SWA's scope of work (1,182 metric tons). Among the eight buildings, the Fire Station has the third highest position regarding contribution of greenhouse gases relative to its square footage (19.20 lbs of CO₂ per Sqft). The table below shows how the Energy Conservation Measures proposed by Steven Winter Associates can reduce the Fire Station greenhouse gas emissions:

Energy Conservation Measures Proposed by SWA

ECM	Cost	Savings kWh/y	Saving Therms/y	CO2 Savings in metric tons	Total Emissions after ECM
Building Lighting Upgrades	\$32,009	30,931	0	18.22412313	88.86
Retro-Commissioning	\$15,370	3,843	885	7.544782993	99.54
Install Premium Efficiency Motors on Heating Pumps	\$1,190	168	0	0.136419048	106.95
Install new condensing boiler	\$10,000	0	753	3.764317007	103.32
Install 5kW PV system	\$37,500	5,672	0	4.605766893	102.48
Total	\$92,316	32,126	1638	34.27540907	72.81