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February 21st, 2010

Local Government Energy Program
Energy Audit Report

For

Denville Township
Main Street Fire House
2 Indian Road
Denville, NJ 07834

Project Number: LGEA08

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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 Denville Township buildings. The audit included a review of the Municipal building as well as the Main Street Fire House. The buildings are located in Denville, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Main Street Fire House building located at 2 Indian Road, Denville, NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Denville Main Street Fire House building, located at 2 Indian Road, was built in 1974 and houses several offices and a large meeting room with an adjacent kitchen. In addition, Fire Department vehicles and other fire fighting and emergency medical equipment are housed in the garage. The Fire House consists of approximately 13,000 square feet of conditioned space and only has one full time employee who is at the building approximately eight hours a day. Due to the nature of a volunteer fire company, this building is accessible 24 hours a day but is volunteer firefighters; emergency medical technicians and other support personnel come and go as needed.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to Denville Township to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

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.

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 7 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Main Street Fire House building located at 2 Indian Road, Denville, NJ. The building is a 3-story building with a floor area of 13,000 square feet. The original structure was built in 1974 and has not undergone any major renovations or additions.

Based on the field visits performed by the SWA staff on May 14th, 15th, 28th and 29th, 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 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.

Existing conditions

From September 2007 through September 2008, the period of analysis for this audit, the building consumed 111,530 kWh or $19,095 worth of electricity at an approximate rate of $0.171/kWh and 4,626 therms or $6,616 worth of natural gas at an approximate rate of $1.43 per therm. The joint energy consumption for the building, including both electricity and fossil fuel, was 843 MMBtus of energy that cost a total of $25,711.

SWA has entered energy information about the Building name building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was ineligible to receive an Energy Star performance rating since the building is classified as a firehouse. SWA encourages Denville Township to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 64.9 kBtu/ft^{2}yr compared to the national average of an office building consuming 75.0 kBtu/ft^{2}yr.

Recommendations

Implementing this report's recommendations will reduce use by approximately 5.3 kBtu/ft^{2}yr, which would decrease the building's energy use intensity to 59.6 kBtu/ft^{2}yr.

Currently, the Main Street Fire House building pays utility rates that were established in 1974, when the building was built. At this time, electricity usage was encouraged over natural gas or oil. SWA recommends that Denville Township first apply energy conservation measures to the Main Street Fire House building, including removing the remaining electrical heating units. After this is complete, Denville Township should contact the local utilities to negotiate both the electric and natural gas rate.

Based on the assessment of the 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

- Remove existing electrical heating equipment that has already been de-commissioned.
- Replace garage door

Category II Recommendations: Operations and Maintenance

- Maintain roofs

- Maintain downspouts
- Provide weather stripping / air sealing
- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **1** Energy Conservation Measures (ECMs) for the Main Street Fire House building that is summarized in the following Table 1. The total investment cost for this ECM with incentives is **$14,100**. SWA estimates a first year savings of **$2,916** with a simple payback of **4.8 years**. SWA also recommends **2** ECMs with a 5-10 year payback that is summarized in Table 2 and another **1** End of Life Cycle ECM that is summarized in Table 3.

The implementation of all the recommended ECMs would reduce the building electric usage by 40,946 kWh annually, or 37% of the building's current electric consumption. Heating conversion to natural gas is recommended. This would increase annual gas usage by an estimated 708 therms or 15% of the building current natural gas consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Main Street Fire House building by **65,510 lbs of CO_2**, which is equivalent to removing approximately 5 cars from the roads each year or avoiding the need of 154 trees to absorb the annual CO_2 produced. SWA also recommends that Denville Township contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.021/kWh, which would have equated to $2,342 for the past 12 months.

There are various incentives that Denville Township could apply for that could also help lower the cost of installing the ECMs. SWA recommends that Denville Township apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, to be rolled out soon, could also assist to cover 80% of the capital investment.

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

The following three tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Remove electric heat, add ductwork	RS Means	14,100	none at this time	14,100	25,950	5.4	-1,064	-1.4	0	2,916	12	28,682	4.8	103.4	8.6	17.8	14,582	34,735
	TOTALS		**14,100**	**0**	**14,100**	**25,950**	**5.4**	**-1,064**	**-1.4**	**0**	**2,916**	**12**	**28,682**	**4.8**	**-**	**-**	**-**	**14,582**	**34,735**

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
2	Upgrade existing lighting	RS Means	9,300	720	8,580	8,604	1.5	0	2.3	155	1,626	15	19,137	5.3	123.0	8.2	17.2	10,557	15,405
3	Install 5 kW PV System	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	1.5	0	4,009	25	68,283	7.5	127.6	5.1	10.3	22,490	10,568
	TOTALS		**44,300**	**5,720**	**38,580**	**14,506**	**6.5**	**0**	**3.8**	**155**	**5,635**	**-**	**87,420**	**6.8**	**-**	**-**	**-**	**33,047**	**25,973**

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 roof and add insulation	RS Means	28,047	0	28,047	490	0	356	2.9	500	1,093	25	18,613	25.7	-33.6	-1.3	-6.1	-9,434	4,802
	TOTALS		**28,047**	**0**	**28,047**	**490**	**0**	**356**	**2.9**	**500**	**1,093**	**25**	**18,613**	**25.7**	**-**	**-**	**-**	**-9,434**	**4,802**

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

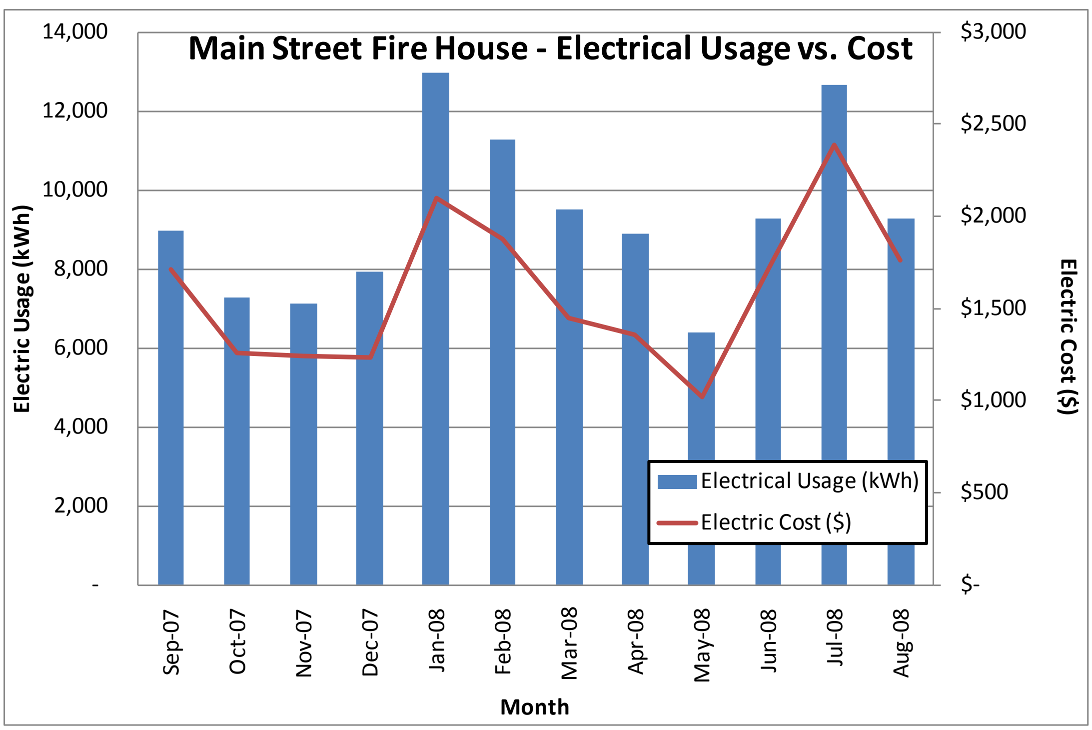
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **September 2007 through September 2008** (period of analysis) that were received from the utility companies supplying the Main Street Fire House building with electric and natural gas.

Electricity - The Main Street Fire House building buys electricity from JCP&L at **an average rate of $0.171/kWh** based on 12 months of utility bills from September 2007 to September 2008. The Main Street Fire House building purchased **approximately 111,530 kWh or $19,095 worth of electricity** in the previous year. The Main Street Fire House building is currently not charged separately for demand (kW).

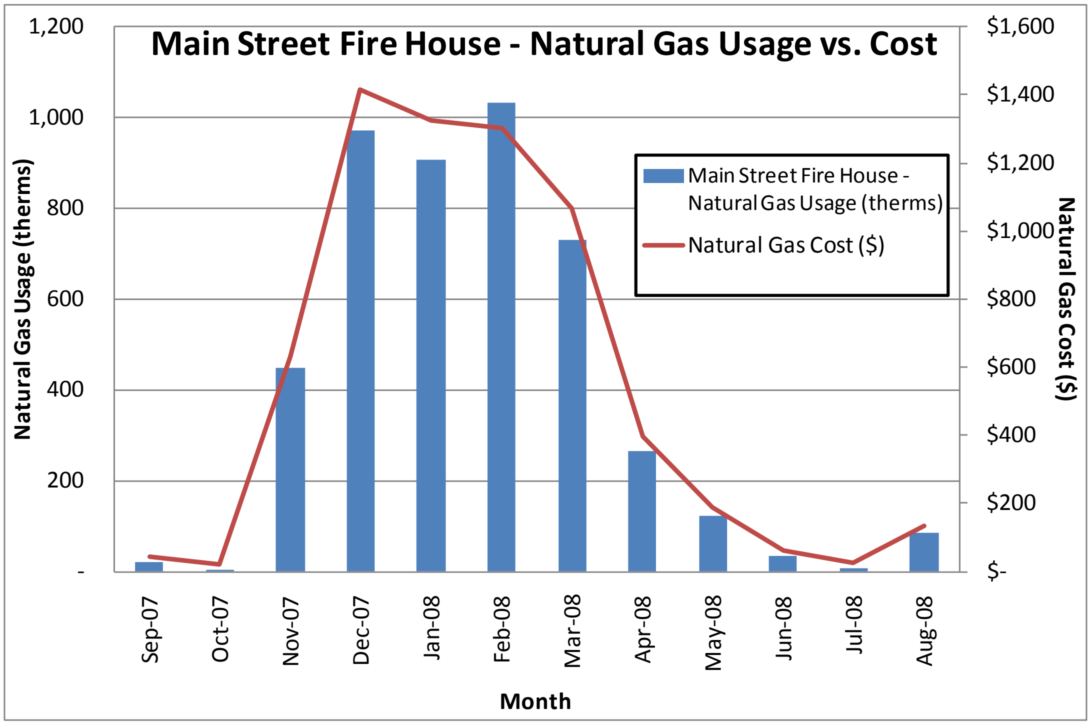
Natural gas - The Main Street Fire House building is currently served by one meter for natural gas. The Main Street Fire House building currently buys natural gas from New Jersey Natural Gas (NJNG) at **an average aggregated rate of $1.43/therm** based on 12 months of utility bills for September 2007 to September 2008. The Main Street Fire House building purchased **approximately 4,626 therms or $6,616 worth of natural gas** in the previous year.

The following chart shows electricity use versus cost for the Main Street Fire House building based on utility bills for the 12 month period of September 2007 to September 2008.



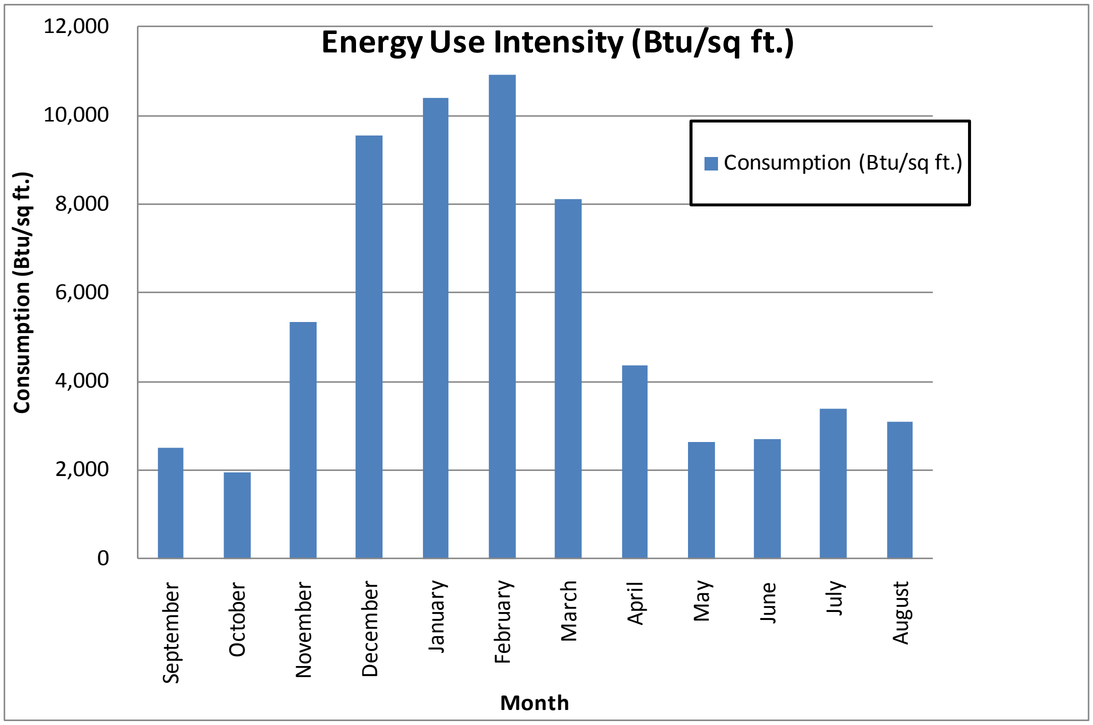
Electricity use peaks during the winter months due to some electric heaters that are still being used. The cost of electricity fluctuates as expected with usage.

The following is a chart of the natural gas annual load profile for the building versus natural gas costs, peaking in the coldest months of the year and a chart showing natural gas consumption following the "heating degree days" curve.



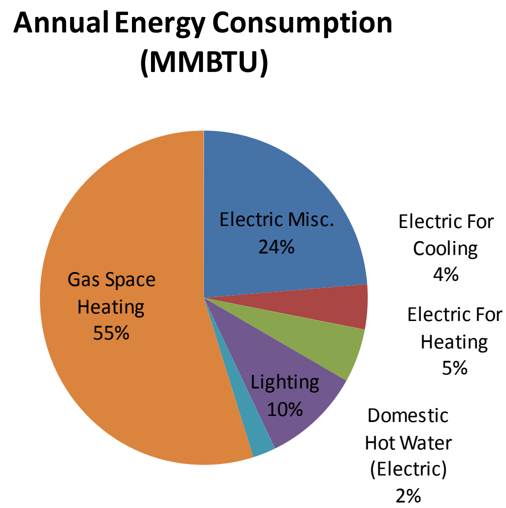
In the above chart, the natural gas use follows a heating trend as expected. During the summer it is clear that the natural gas use is very minimal which reflects that heat is not being used and the domestic hot water (DHW) load is minimal. In January 2008, the Main Street Fire House building was overbilled for natural gas and this was reconciled in February 2008.

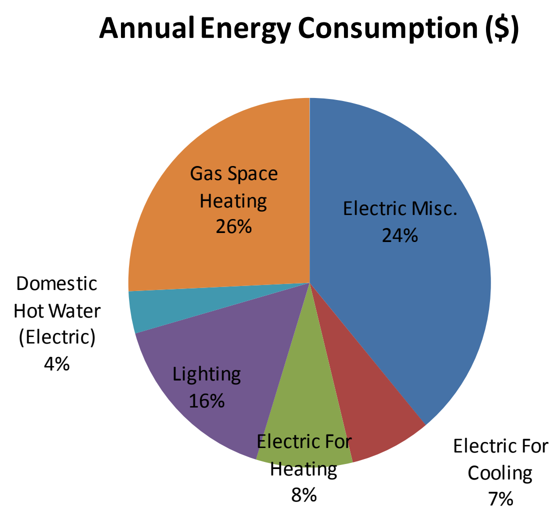
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Main Street Fire House building based on utility bills for the 12 month period of September 2007 to September 2008.



The following table and chart pies show energy use for the Main Street Fire House building based on utility bills for the 12 month period of September 2007 to September 2008. Note electrical cost at $50.1/MMBtu of energy is more than 3.5 times as expensive to use as natural gas at $14.3/MMBtu.

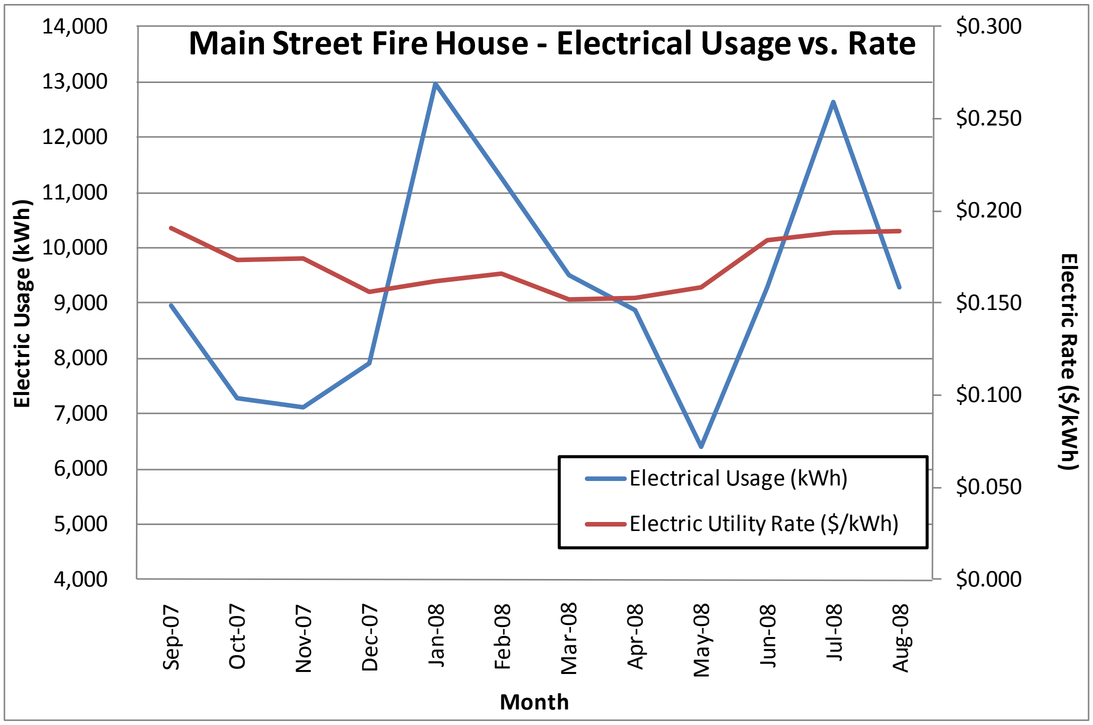
2008 Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	200	24%	$10,020	44%	50.1
Electric For Cooling	37	4%	$1,854	17%	50.1
Electric For Heating	44	5%	$2,204	13%	50.1
Lighting	81	10%	$4,058	6%	50.1
Domestic Hot Water (Electric)	19	2%	$952	2%	50.1
Gas Space Heating	463	55%	$6,616	18%	14.3
Totals	844	100%	$25,704	100%	-
Total Electric Usage	381	45%	$19,095	74%	50.1
Total Gas Usage	463	55%	$6,616	26%	14.3
Totals	844	100%	$25,711	100%	-





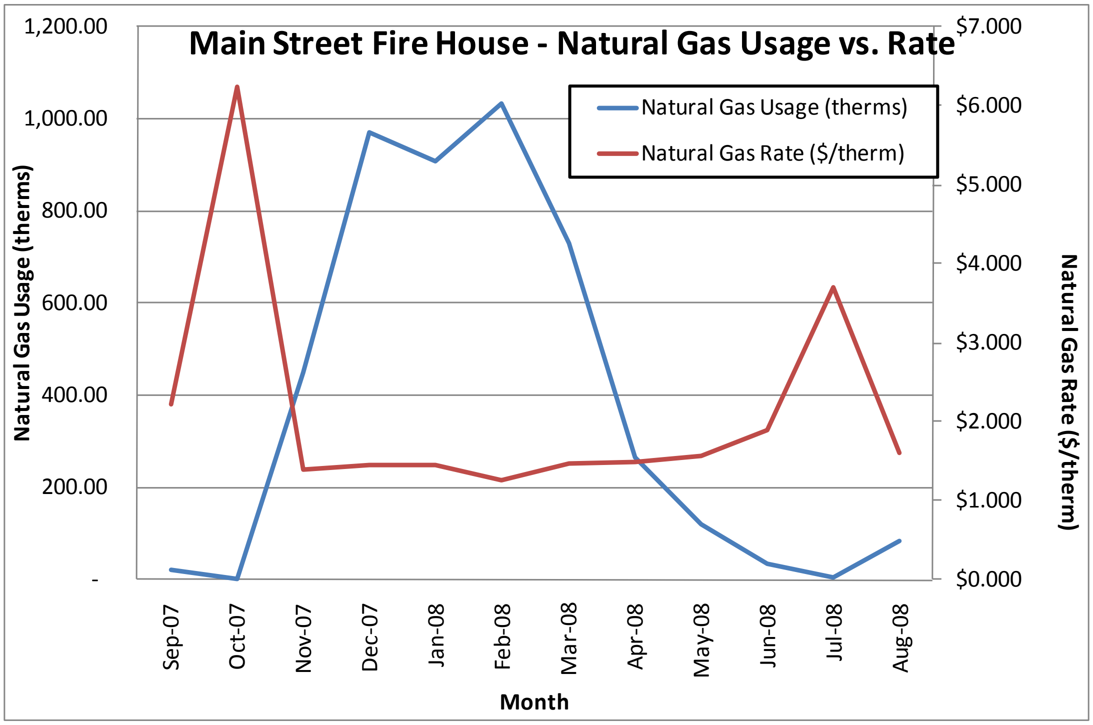
1.2. Utility rate analysis

The Main Street Fire House building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) with no separate (kW) demand charge. The Main Street Fire House building currently pays an average rate of approximately $0.171/kWh based on the 12 months of utility bills of September 2007 to September 2008. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year and therefore appears to be the appropriate rate for the building.



The Main Street Fire House building currently purchases natural gas supply from the NJNG at a general service market rate for natural gas (therms). There is one gas meter that provides natural gas service to the Main Street Fire House building currently. The average aggregated rate (supply and transport) for the meter is approximately $1.43/therm based on 12 months of utility bills for September 2007 to September 2008. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Main Street Fire House 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 rooftop furnace units. The high gas price per therm fluctuations in the summer may be due to high energy costs that occurred in 2008 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 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 Main Street Fire House building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating since it is classified as a firehouse building.

The Site Energy Use Intensity is 64.9 kBtu/sq ft yr compared to the national average of an Office building consuming 75.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will increase use slightly, but will have an additional savings of 3.8 kBtu/sq ft yr from the recommended ECMs and 2.9 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Per the LGEA program requirements, SWA has assisted Denville to create an *Energy Star Portfolio Manager* account and has shared the Firehouse building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

[redacted]

Also, below is a performance rating that is generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Denville Township - Main Street Fire House

Building ID: 1933066
For 12-month Period Ending: August 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: November 12, 2009

Facility
Denville Township - Main Street Fire House
2 Indian Road
Denville, NJ 07834

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1974
Gross Floor Area (ft²): 13,000

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	380,540
Natural Gas (kBtu)[4]	462,628
Total Energy (kBtu)	843,168
Energy Intensity[5]	
Site (kBtu/ft²/yr)	65
Source (kBtu/ft²/yr)	135
Emissions (based on site energy use)	
Greenhouse Gas Emissions (MtCO$_2$e/year)	83
Electric Distribution Utility	
Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-14%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

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

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

Certifying Professional
N/A

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

The government estimates the average time needed to fill out this form is 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 Main Street Fire House was built around 1974. The structure is three stories tall with a total floor area of approximately 13,000 square feet. The first floor area consists of mostly a high bay garage where fire trucks and other equipment are stored. The second floor contains office space which includes the fire chief's office and a few small storage rooms. The third floor is mostly used as a meeting space as well as hosting local events sponsored by the fire department.

2.2. Building occupancy profiles

The Fire House has only one full time employee. The Main Street Fire House is a volunteer fire house that is accessible 24 hours per day but is primarily used as emergency calls come in. For the purpose of this audit, it is assumed that the garage, lounge and office areas are used for 4 hours per day. According to building staff, the fire department receives 4-5 emergency calls per day.

2.3. Building envelope

2.3.1. Exterior Walls

The Fire House walls are concrete blocks with a ribbed face. The exterior walls are a reddish color and showed no major thermal weaknesses. The interior side of the block walls is steel framed, 16" on center. Due to warm temperature conditions at the time of the field visits, insulation levels could also not be verified with help of infrared technology.

Overall, exterior and interior wall finishes of the envelope were found to be in age-appropriate, good condition with no major signs of unusual water or air leakage.

Concrete blocks with ribbed face

2.3.2. Roof

The Fire House has a flat roof that has a dark grey surface consisting of built-up roofing. The roof is supported by steel I-beams and no insulation. The roof, which is believed to be original to the building, is in deteriorating condition and shows signs of water damage. It was observed that there are several structurally weak spots on the roof.

SWA has determined that the roof has reached the end of its useful life and should be replaced in order to form a proper ceil at the top of the building. Replacing the roof will prevent future water leaks as well as provide the opportunity for insulation to be added in order to keep warm air from rising directly out of the building. Roof replacements do not typically have a positive return on investment due to the high installation cost but should be incorporated into a capital improvement plan.

Built-up roofing

2.3.3. Base

The building's base is 6" concrete slab-on-grade. There were no reported problems with water penetration or moisture. The building code in 1974 would not have required insulation at either the perimeter of the foundation walls or under the slab. The benefits of installing slab perimeter insulation would not justify the expense and disruption of excavating around the entire building. If excavation is ever require for other reasons, consideration should be given to installing a minimum of 2 inches of rigid foam board insulation at that time.

2.3.4. Windows

The windows are mostly double-hung operable windows with aluminum frames and double glass panes. The three windows in the conference hall are awning-type operable windows with fixed lights above. The windows are in fair condition, although some of the weather-stripping is in deteriorating condition. The expense of installing new windows would not be cost-effective, especially considering the limited occupancy of the building.

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

Typical Fire House Window

2.3.5. Exterior doors

The exterior entry/egress doors are in good condition with the weather-stripping still intact. The double, metal-clad doors to the ramp at the back of the building are in satisfactory condition. The single, metal-clad door at the back northwest corner is extremely loose with no evident weather-stripping. The entire perimeter of this door should be weather-stripped as soon as possible. SWA recommends maintaining weather-stripping around all of the doors of the building in order to prevent conditioned air from leaking outside of the building. Weather-stripping should be checked at least once a year and replaced as soon as signs of deterioration start to show.

The garage area is heated but the space is not served by a cooling system. During the heating season, the large overhead doors should be kept closed whenever possible to save energy, provide comfort for those working in the garage bays, and prevent freezing of any equipment. To minimize energy waste, garage occupants should be made aware of energy concerns and heating systems should be shut-off when the doors are left open during the spring and fall. If the system is manually disabled, occupants must ensure the system is reset prior to leaving in order to prevent freezing overnight. SWA suggests that control systems be explored to provide a higher level of control for this application.

If not properly maintained, exterior doors and overhead doors can become major sources of heat loss and infiltration. 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. When it becomes necessary to replace any or all of the overhead garage doors, insulated doors with good weather-stripping should be strongly considered. This will provide increased comfort, as well as energy savings during the heating season.

Please note: The garage ventilation system and controls should be investigated prior to incorporation of any recommendations associated with closing the overhead doors to the garage bays and providing improved air sealing around the overhead doors. To ensure safety, SWA suggests that the ventilation system be regularly checked to ensure proper operation. Adequate fresh air is particularly important in the garage, where mechanics often work on fuel-burning vehicles and equipment that may be allowed to idle indoors. If the previously recommended controls are added to the heating system, this work should be coordinated with the operation of the ventilation system.

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 and windows. The previously noted back door that rattles back and forth against the jambs is causing some infiltration of unconditioned air. As a best practice, penetrations and doors connecting the main building to the garage should be routinely inspected to prevent transfer of combustion products into the main building. The overhead garage doors should be used judiciously in the winter months and as comfort demands in the summer.

2.4. HVAC Systems

A majority of the building is served by two large Lennox rooftop units that perform as a gas-fired furnace as well as DX cooling. Based on this system type, there is some duplication in the terminal descriptions in sections 2.4.1 and 2.4.2 below.

In general, much of the terminal equipment was performing properly. There are some areas, such as the Chief's office, where comfort issues exist. This condition has caused the Chief's office to rely on a packaged heating/cooling combination window unit to provide comfort for this area.

2.4.1.Heating

The heating system includes different pieces of equipment throughout the building. The garage is heated using three gas-fired infrared heating units that are mounted from the ceiling. These infrared units are controlled by a thermostat in the garage and are used mostly when the garage is actively being used during the winter. These units are newer and are operating well.

The majority of rooms on the second and third floors are heated using two Lennox packaged rooftop units. These units are ducted to the individual rooms which includes the large meeting room, bathrooms and the Chief's office. These units are aging but are still in good operating condition due to the limited operating hours of the building. Each of these units is controlled by one thermostat that is located on either end of the large meeting room on the third floor. The placement of these thermostats has caused some problems since they are constantly adjusted by people attending meetings. In addition, the Chief's office located on the 2nd floor is controlled by one of the thermostats located in the large meeting room on the 3rd floor. Since the Chief's office is used on a daily basis and the meeting room is only used occasionally, SWA recommends that a thermostat be placed in the Chief's office as well. SWA also recommends that building staff continue to maintain the heating units in order to extend their useful lifetime and prevent comfort problems within the general building space.

The Main Street Fire House building was built around 1974 and was originally electrically heated throughout the entire building. Over the last 7-10 years, the majority of the building has been converted to gas heating with the exception of the fireman's lounge, the first floor bathroom, and a first floor storage room and also a storage room located next to the Chief's office on the second floor. The fireman's lounge is heated using electric baseboard heating. The storage rooms are all heated using ceiling-mounted, flat electric panels in each room. For each room with electric heating, there is a thermostatic control in each room. These panels are not energy efficient since they require a large amount of electricity for resistive heating. In addition, since heat rises, these panels are inefficient at providing high comfort levels since they are ceiling mounted and a majority of the heat rises from the unit and warms the space above the unit instead of the room they are located in. SWA recommends that the remaining electric heating is removed and replaced with gas heating. The most cost-effective option would be to use existing rooftop units, if possible and also to use existing ductwork where possible and create branches from the main runs to areas that previously had electric heating. Based on preliminary observations during the energy audit, it appears as though the rooftop units may be oversized. The Main Street Fire House building may have the opportunity to take advantage of this excess capacity and provide more heating, cooling and comfort to problem areas. In order to make changes to the heating system, a heating load calculation will have to be performed to determine the amount of heat required to heat new zones. Based on the heating load study, an engineer should determine if the existing units have excess capacity and if this excess capacity is enough to meet the additional heating load required by the new heating zones. If the existing units do not have enough capacity, then they should be resized and replaced with newer, higher capacity equipment.

There weren't many complaints about the ability of the heating system to provide adequate comfort to the building occupants except for in the Chief's office. Building staff at the Main Street Fire House expressed concern with the electric bills and would like to see the rest of the electric heating removed from the building. SWA recommends that ductwork be added to extend the amount of conditioned air brought into the firehouse, if possible. The amount of ductwork is dependent upon the results of a heating load calculation. A heating load calculation will determine if the existing equipment is oversized and will help determine the possibility of increasing the amount of ductwork versus adding more equipment.

It should be noted that in addition to extra ductwork, additional thermostats should be added to areas that previously were not serviced by the rooftop units. The cost of programmable thermostats will be taken into account, when the savings for this measure are calculated. As part of the heating recommendation, SWA will also recommend that all thermostats are upgraded to programmable thermostats.

2.4.2. Cooling

The building is cooled using the same rooftop units that provide heating for the building. Cool air is provided the same ductwork as the heating system and is also controlled by the same thermostats. There are a few rooms such as the Fireman's lounge and Chief's office that use window AC units for cooling. These rooms are used more often than other parts of the building and therefore comfort issues will be more pronounced than other areas of the building. A majority of the rooms in the Main Street Fire House building are used on an occasional basis, cooling is less of an issue than heating in these rooms.

Cooling problems within the Main Street Fire House building are similar to the heating problems. Adding ductwork, as recommended above in the heating section, will also help alleviate the problems associated with the cooling system. Adding more ductwork can allow for the building to distribute conditioned air, which includes fresh air, warm air and cool air, more efficiently throughout the building. Making change to the distribution system should allow for removal of the window AC units in offices.

2.4.3. Ventilation

As mentioned above, a majority of the building is provided conditioned air from the two rooftop units. These rooftop units mix fresh air with re-circulated air in order to distribute air throughout the building. The mix of fresh air from the rooftop units in combination with exhaust fans located in the bathrooms that help induce fresh air into the building provides the ventilation throughout the building.

The building has a number of rooftop exhaust fans, and it is assumed that a few are at the end of their operating lives. They should be replaced in kind. The fan motors are small and the replacement units will have negligible energy savings over the existing.

2.4.4. Domestic Hot Water

There is one (1) Ruud Commercial electric hot water heater located in the garage of the Main Street Fire House. This unit serves domestic hot water to the Banquet Hall and bathrooms of the building. There are no complaints with hot water for the building.

2.5. Electrical systems

2.5.1.Lighting

Interior Lighting – The Main Street Fire House building currently consists of mostly inefficient T12 fluorescent fixtures with magnetic ballasts. Based on measurements of lighting levels for each space, there are not any vastly over-lighted areas. There are also some incandescent bulbs found in fixtures. All of the interior fixtures are controlled by switches inside of each specific room. Due to the limited usage of the building, SWA does not recommend retrofitting each light fixture with an occupancy sensor. SWA recommends replacement of all T12 fluorescent lighting with magnetic ballasts to T8 fluorescent lighting with electronic ballasts. SWA also recommends that all incandescent bulbs are replaced with compact fluorescents. 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 LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit were found to be a mix of metal halide and incandescent fixtures. SWA recommends the replacement of all exterior metal halide and incandescent lights with compact fluorescent lights. Exterior lighting is controlled by photocells.

2.5.2.Appliances

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 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. The Firehouse building computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3.Elevators

The Main Street Fire House building does not have any installed elevators.

2.5.4.Process and others electrical systems

There are not currently any other significant energy impacting electrical systems installed at the Main Street Fire House building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating	Dry Gear Professional electric equipment dryer, Dayton Industrial, 3HP, 3500 RPM, 77% Eff., PF 81, installed 2007	Garage; left side	Dry Gear Professional, Model #6K145BA	Electricity	Garage	80%
Heating	DECOMMISSIONED Unit Heater - Federal Pacific , 208V, 10kW, 3Ph, 60Hz	Garage	Federal Pacific, Cat #USA28103	Electricity	Garage	0%
Heating/Cooling	RTU- Lennox 240 MBH in, 192 MBH Out, R-22, 9.5 EER, 50% thermal eff. 5 HP	Roof	Lennox, Model #TGA150S2BH, Serial #5608H22180	Natural Gas/Electricity	2nd and 3rd floors	40%
Heating/Cooling	RTU- Lennox , 240 MBH in, 192 MBH Out, R-22, 9.5 EER, 50% thermal eff. 5 HP	Roof	Lennox, Model #TGA150S2BH1Y, Serial #5604D14403	Electricity	2nd and 3rd floors	40%
Heating	Three infrared heating units, mounted from ceiling, nameplate could not be accessed	Garage	NA	Natural Gas	Garage	80%
Heating/Cooling	One (1) window packaged heating/cooling unit, no nameplate	Chief's office	NA	Electricity	Chief's Office	10%
Cooling	One (1) window AC unit, no nameplate	Fireman's Lounge	NA	Electricity	Fireman's Lounge	10%
Domestic Hot Water	Ruud Commercial , 67 Gal, 120 MBH	Garage	Ruud, Model #GL67-120 Serial #RUN0387402169	Electricity	Banquet Hall & Bathrooms	30%
Ventilation	Exhuast Fan Small	Roof	NA	Electricity	Bathrooms	20%
Ventilation	Exhuast Fan Medium	Roof	NA	Electricity	Bathrooms	20%
Ventilation	Exhuast Fan Large	Roof	NA	Electricity	Bathrooms	20%

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 Main Street Fire House, 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

- Remove any existing electrical heating equipment – There are currently several unit heaters located in the garage areas that have been disconnected from the electrical supply. Some of these units appear to still be connected and therefore become a risk to being turned on unintentionally and increasing electricity bills. Typically, any equipment that is no longer used should be disconnected properly and removed from the site. Removal from the site assures that this equipment cannot be reconnected and also increase amount of available space within the building.

- Replace garage door - with an updated overhead door and improved insulation (2” polystyrene or better).

Category II Recommendations: Operations and Maintenance

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

- Maintain downspouts - Repair / install missing / disconnected / damaged downspouts 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 weep holes, install proper flashing, and correct masonry efflorescence and 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.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Remove remaining electric heat and add ductwork to existing rooftop-based system
	Description of Recommended 5-10 Year Payback ECMs
2	Upgrade existing lighting – as per lighting schedule in Appendix A
3	Install 5 kW Photovoltaic system
	Description of Recommended End of Life Cycle ECMs
4	Replace roof and add insulation

ECM#1: *Remove remaining electric heat and add ductwork to existing rooftop-based system.*

Description:

The majority of rooms on the second and third floors are heated using two Lennox packaged rooftop units. These units are ducted to the individual rooms that they serve and are believed to be oversized. SWA recommends hiring a design engineering firm to first determine the heating load of the building, which should include a separate calculation to determine the heating load of rooms that still have remaining electric heat. After the heating load calculation, an engineer should determine if the rooftop units have enough excess capacity to serve the additional rooms that electric heat is to be removed from. SWA recommends that based on these calculations, extra ductwork is added to the existing system to distribute conditioned air to the rest of the building. This extra ductwork should provide the 1st floor Fireman's lounge, bathroom, storage closet as well as the 2nd floor storage rooms. Adding distribution to the existing rooftop system should alleviate current comfort problems as well as reduce energy use and cost associated with electric heating. In addition, remaining window AC and window packaged units will no longer be necessary and will be able to be removed from the building. It is also important as part of this recommendation that the control side of the rooftop units is better managed. Instead of each rooftop unit having a thermostat located in the large meeting room, one thermostat should be moved down to the Chief's office since it is used on a daily basis. This will ensure that the rooftop units can be controlled on by temperature set points in the most often used room. Currently, temperature is controlled by a thermostat in the large meeting room on the 3rd floor and must constantly be adjusted to provide adequate comfort to the Chief's office on the second floor.

It should be noted that in addition to extra ductwork, there will be an additional cost associated with hiring an engineer to perform a heating load calculation and determine the excess capacity of the rooftop units. There are currently two programmable thermostats located in the large meeting room on the 3rd floor. SWA recommends that both of these thermostats are replaced with a newer technology thermostat that is easier to understand and use. These thermostats should have a night setback feature as well. One of the thermostats should be moved to the Chief's office. The installed cost for this measure includes the cost of installing additional ductwork as well as installing two new programmable thermostats.

Installation cost:

Estimated installed cost: $14,100
Source of cost estimate: RS *Means; Published and established costs*

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
1	Remove remaining electric heaters, add ductwork	Similar projects	14,100	none at this time	14,100	25,950	5.4	-1,064	-1.4	0	2,916	12	28,682	4.8	103.4	8.6	17.8	14,582	34,735

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling for the Main Street Fire House building. Based on experience with similar buildings and based on electrical base load, SWA estimated the heating and cooling energy consumption. Installation costs include ductwork as well as the installation of two programmable thermostats. Electrical demand reduction has been estimated as 0 kW in the above chart since demand reduction will only occur during winter months.

Rebates / financial incentives:

There are currently no incentives for this measure at this time.

Options for funding ECM:

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

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

ECM#2: *Upgrade existing lighting*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Main Street Fire House building (see Appendix A). The Main Street Fire House building currently consists of mostly inefficient T12 fluorescent fixtures with magnetic ballasts. Based on measurements of lighting levels for each space, there are not any vastly over-lighted areas. There are also some incandescent bulbs found in fixtures. All of the interior fixtures are controlled by switches inside of each specific room. Due to the limited usage of the building, SWA does not recommend retrofitting each light fixture with an occupancy sensor. SWA recommends replacement of all T12 fluorescent lighting with magnetic ballasts to T8 fluorescent lighting with electronic ballasts. SWA also recommends that all incandescent bulbs are replaced with compact fluorescents. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Installation cost:

Estimated installed cost: $9,300
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program (a)*

Economics (Some of the options considered 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
2	Upgrade existing lighting	RSMeans	9,300	720	8,580	8,604	1.5	0	2.3	155	1,626	15	19,137	5.3	123.0	8.2	17.2	10,557	15,405

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 Prescriptive Lighting – T-5 and T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity of lamps)
Maximum incentive amount is $720.

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

ECM#3: *Install 5kW PV system*

Description:

Currently, the Main Street Fire House 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 Denville Township 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. The Main Street Fire House building is not eligible for a 30% federal tax credit. Instead, Denville Township may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides 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 roofs and away from shade. 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: $30,000
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
3	Install 5 kW PV System	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	1.5	0	4,009	25	68,283	7.5	127.6	5.1	10.3	22,490	10,568

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (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:

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 per year for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

ECM#4: *Replace roof and add insulation*

Description:

The Fire House has a flat roof that has a dark grey surface consisting of built-up roofing. The roof is supported by steel I-beams and no insulation. The roof is in deteriorating condition and shows signs of water damage. It was observed that there are several structurally weak spots on the roof. The roof is believed to be original to the building and will need to be replaced soon.

SWA has determined that the roof has reached the end of its useful life and should be replaced in order to form a proper ceil at the top of the building. Replacing the roof will prevent future water leaks as well as provide the opportunity for insulation to be added in order to keep warm air from rising directly out of the building. Roof replacements do not typically have a positive return on investment due to the high installation cost but should be incorporated into a capital improvement plan.

Installation cost:

Estimated installed cost: $28,047
Source of cost estimate: *RSMeans; Published and established costs*

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
4	Replace roof and add insulation	RSMeans	28,047	0	28,047	490	0	356	2.9	500	1,093	25	18,613	25.7	-33.6	-1.3	-6.1	-9,434	4,802

Assumptions: SWA estimated the cost and savings of the system based on an eQUEST model where R-30 insulation was added to the surface of the roof. In addition to energy savings, SWA assumes that the Main Street Fire House building will avoid $500 per year in maintenance costs associated with water damage and other repair issues associated with the age of the roof

Rebates/financial incentives:

There are currently no incentives available for this measure.

Options for funding ECM:

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

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

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

Pleases see the above recommended ECM#3.

5.4. Solar Thermal Collectors

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

CHP is not applicable for this building because of the existing HVAC system and insufficient domestic hot water use.

5.6. Geothermal

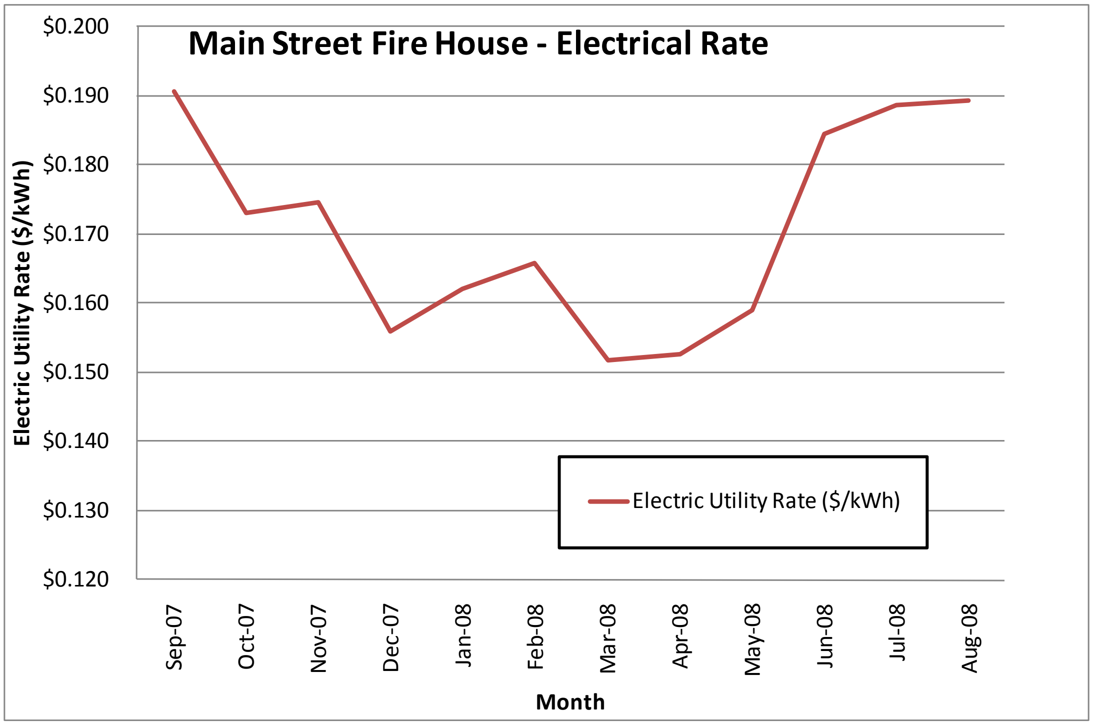
Geothermal is not applicable for this building because it would not be cost effective considering the small cooling load and limited operating hours of this building.

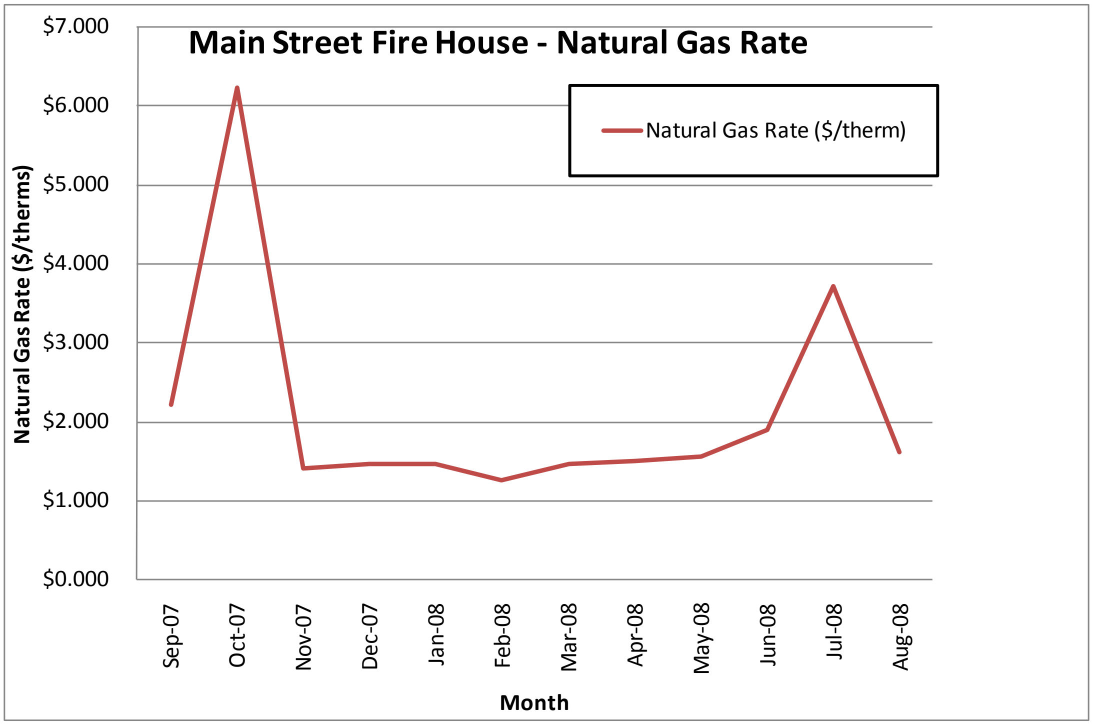
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

The Main Street Fire House building receives natural gas via one incoming meter. New Jersey Natural Gas supplies gas to the building. 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 Street Fire House building from JCP&L without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations of 20% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 80% 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.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $1.55/therm for natural gas. Currently, the electricity rate for Main Street Fire House is $.171/kWh, which means there is a potential cost savings of $2,342 per year. The current natural gas rate for the Main Street Fire House building is $1.43/therm which is better than the average natural gas cost. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that Denville Township further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Main Street Fire House building. Appendix B contains a complete list of third party energy suppliers for the Denville Township service area. Denville Township may want to consider partnering with other school districts, municipalities, townships 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.





6.2. Energy Procurement strategies

Also, the Main Street Fire House 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.

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 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**	**Staircase**	**Parabolic**	**M**	**4'T12**	**2**	**4**	**34**	**S**	**4**	**365**	**24**	**296**	**467**	**T8**	**Parabolic**	**4'T8**	**M**	**S**	**2**	**4**	**32**	**4**	**365**	**6**	**262**	**391**	**76**	**0**	**76**
2	1	Stair - Trophy Case	Parabolic	M	4'T12	2	1	34	S	4	365	15	83	143	N/A	Parabolic	4'T12	M	S	2	1	34	4	365	15	83	143	0	0	0
3	**1**	**Stair - Chandelier**	**Screw**	**N**	**Inc**	**18**	**1**	**60**	**S**	**4**	**365**	**1**	**1,081**	**1,603**	**CFL**	**Screw**	**CFL**	**N**	**S**	**18**	**1**	**20**	**4**	**365**	**1**	**361**	**552**	**1,051**	**0**	**1,051**
4	1	Garage	Parabolic	M	8'T12	10	2	68	S	4	365	18	1,378	2,248	N/A	Parabolic	8'T8	M	S	10	2	68	4	365	18	1,378	2,248	0	0	0
5	1	Garage	Exit sign	N	LED Exit	2	2	5	S	24	365	1	21	193	N/A	Exit sign	LED Exit	N	S	2	2	5	24	365	1	21	193	0	0	0
6	**1**	**Garage - control booth**	**Parabolic**	**M**	**4'T12**	**2**	**4**	**34**	**OS**	**4**	**365**	**24**	**296**	**467**	**T8**	**Parabolic**	**4'T8**	**M**	**OS**	**2**	**4**	**32**	**4**	**365**	**6**	**262**	**391**	**76**	**0**	**76**
7	**1**	**Staircase**	**Parabolic**	**M**	**4'T12**	**3**	**4**	**34**	**OS**	**4**	**365**	**24**	**432**	**701**	**T8**	**Parabolic**	**4'T8**	**M**	**OS**	**3**	**4**	**32**	**4**	**365**	**6**	**390**	**587**	**114**	**0**	**114**
8	1	Garage	Parabolic	M	8'T12	2	2	68	S	4	365	18	290	450	N/A	Parabolic	8'T12	M	S	2	2	68	4	365	18	290	450	0	0	0
9	1	Garage	Parabolic	M	8'T12	2	2	68	S	4	365	18	290	450	N/A	Parabolic	8'T12	M	S	2	2	68	4	365	18	290	450	0	0	0
10	**1**	**Lounge**	**Parabolic**	**M**	**4'T12**	**2**	**4**	**32**	**S**	**4**	**365**	**24**	**280**	**444**	**T8**	**Parabolic**	**4'T8**	**M**	**S**	**2**	**4**	**32**	**4**	**365**	**6**	**262**	**391**	**53**	**0**	**53**
11	**1**	**Bathroom**	**Parabolic**	**M**	**4'T12**	**2**	**2**	**34**	**S**	**4**	**365**	**18**	**154**	**251**	**T8**	**Parabolic**	**4'T8**	**M**	**S**	**2**	**2**	**32**	**4**	**365**	**3**	**131**	**196**	**55**	**0**	**55**
12	1	Storage Rm	Parabolic	M	4'T12	1	4	34	S	2	365	24	160	117	N/A	Parabolic	4'T12	M	S	1	4	34	2	365	24	160	117	0	0	0
13	1	Storage Rm	Parabolic	M	4'T12	1	4	34	S	2	365	24	160	117	N/A	Parabolic	4'T12	M	S	1	4	34	2	365	24	160	117	0	0	0
14	**2**	**Hallway**	**Recessed**	**M**	**4'T12**	**2**	**4**	**34**	**S**	**12**	**365**	**24**	**296**	**1,402**	**T8**	**Recessed**	**4'T8**	**M**	**S**	**2**	**4**	**32**	**12**	**365**	**6**	**262**	**1,174**	**228**	**0**	**228**
15	**2**	**Office chiefs**	**2'U-Shped**	**M**	**T12 U**	**10**	**2**	**24**	**S**	**8**	**365**	**18**	**498**	**1,927**	**T8**	**2'U-Shped**	**T8 U**	**M**	**S**	**10**	**2**	**18**	**8**	**365**	**4**	**364**	**1,168**	**759**	**0**	**759**
16	2	Storage Rm	Recessed	M	4'T12	1	2	34	S	2	365	18	86	63	N/A	Recessed	4'T12	M	S	1	2	34	2	365	18	86	63	0	0	0
17	3	Storage Rm	Recessed	M	4'T12	1	2	34	S	2	120	18	86	21	N/A	Recessed	4't12	M	S	1	2	34	2	120	18	86	21	0	0	0
18	3	Bathroom Men	Recessed	M	4'T12	2	4	34	OS	4	120	24	296	154	N/A	Recessed	4'T12	M	OS	2	4	34	4	120	24	296	154	0	0	0
19	3	Bathroom Women	Recessed	M	4'T12	2	4	34	OS	4	120	24	296	154	N/A	Recessed	4'T12	M	OS	2	4	34	4	120	24	296	154	0	0	0
20	3	Kitchen	Recessed	M	4'T12	2	4	34	OS	4	120	24	296	154	N/A	Recessed	4'T12	M	OS	2	4	34	4	120	24	296	154	0	0	0
21	3	Meeting Rm	Recessed	M	4'T12	35	4	34	OS	4	120	24	4,784	2,688	N/A	Recessed	4'T12	M	OS	35	4	34	4	120	24	4,784	2,688	0	0	0
22	3	Meeting Rm	Exit sign	N	LED Exit	2	1	5	N	24	120	1	11	35	N/A	Exit sign	LED Exit	N	N	2	1	5	24	120	1	11	35	0	0	0
23	**3**	**Meeting Rm-bar**	**Screw**	**N**	**Inc**	**7**	**1**	**65**	**S**	**4**	**120**	**0**	**455**	**218**	**CFL**	**Screw**	**CFL**	**N**	**S**	**7**	**1**	**22**	**4**	**120**	**1**	**153**	**76**	**142**	**0**	**142**
24	**3**	**Meeting Rm**	**Screw**	**N**	**Inc**	**34**	**1**	**65**	**S**	**4**	**120**	**0**	**2,210**	**1,061**	**CFL**	**Screw**	**CFL**	**N**	**S**	**34**	**1**	**22**	**4**	**120**	**1**	**738**	**370**	**691**	**0**	**691**
25	3	Meeting Rm	Recessed	M	8'T12	1	1	68	S	4	120	18	86	41	T8	Recessed	8'T8	M	S	1	1	68	4	120	18	86	41	0	0	0
26	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**2**	**1**	**175**	**PC**	**12**	**365**	**40**	**390**	**1,883**	**CFL**	**Exterior**	**CFL**	**N**	**PC**	**2**	**1**	**60**	**12**	**365**	**12**	**132**	**631**	**1,253**	**0**	**1,253**
27	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**2**	**1**	**250**	**PC**	**12**	**365**	**58**	**558**	**2,698**	**CFL**	**Exterior**	**CFL**	**N**	**PC**	**2**	**1**	**85**	**12**	**365**	**20**	**190**	**920**	**1,778**	**0**	**1,778**
28	**Ext**	**Exterior**	**Exterior**	**N**	**Inc**	**6**	**1**	**65**	**PC**	**12**	**365**	**0**	**390**	**1,708**	**CFL**	**Exterior**	**CFL**	**N**	**PC**	**6**	**1**	**22**	**12**	**365**	**1**	**131**	**596**	**1,113**	**0**	**1,113**
29	Ext	Exterior	Exterior	N	CFL	2	1	26	PC	12	365	2	54	245	N/A	Exterior	CFL	N	PC	2	1	26	12	365	2	54	245	0	0	0
30	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**1**	**1**	**250**	**PC**	**12**	**365**	**58**	**308**	**1,349**	**CFL**	**Exterior**	**MH**	**N**	**PC**	**1**	**1**	**16**	**12**	**365**	**58**	**74**	**324**	**1,025**	**0**	**1,025**
31	**Ext**	**Exterior**	**Exterior**	**N**	**Inc**	**1**	**1**	**65**	**PC**	**12**	**365**	**0**	**65**	**285**	**CFL**	**Exterior**	**Inc**	**N**	**PC**	**1**	**1**	**22**	**12**	**365**	**0**	**22**	**95**	**190**	**0**	**190**
32	Ext	Exterior	Exterior	N	CFL	1	1	32	PC	12	365	2	34	149	N/A	Exterior	CFL	N	PC	1	1	32	12	365	2	34	149	0	0	0
Totals:						163	73	1,867	0			586	16,120	23,884						163	73	1,124			404	12,144	15,281	8,603	0	8,603

Note: Bolded items in yellow represent fixtures with proposed improvements

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for NJNG Service Territory	Telephone & Web Site
Cooperative Industries	(800) 628-9427
412-420 Washington Avenue	www.cooperativenet.com
Belleville, NJ 07109	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
Gateway Energy Services Corp.	(800) 805-8586
44 Whispering Pines Lane	www.gesc.com
Lakewood, NJ 08701	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
Intelligent Energy	(800) 724-1880
2050 Center Avenue, Suite 500	www.intelligentenergy.org
Fort Lee, NJ 07024	
Metromedia Energy, Inc.	(877) 750-7046
6 Industrial Way	www.metromediaenergy.com
Eatontown, NJ 07724	
MxEnergy, Inc.	(800) 375-1277
510 Thornall Street, Suite 270	www.mxenergy.com
Edison, NJ 08837	
NATGASCO (Mitchell Supreme)	(800) 840-4427
532 Freeman Street	www.natgasco.com
Orange, NJ 07050	
NJ Gas & Electric	(866) 568-0290
1 Bridge Plaza, Fl. 2	www.NewJerseyGasElectric.com
Fort Lee, NJ 07024	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main Street	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Woodruff Energy	(800) 557-1121
73 Water Street	www.woodruffenergy.com
Bridgeton, NJ 08302	