BOROUGH OF OCEAN GATE
FIRE HALL
ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

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TABLE OF CONTENTS

APPENDICES

A	Utility Usage Analysis
B	ECM-1 Install Roof Insulation
C	ECM-2 Boiler Replacement with Hot Water Temperature Reset
D	ECM-3 Temperature Setback
E	ECM-4 Install Garage Door Seals
F	ECM-5 Replace T12 Lights
G	ECM-6 Install IR Heaters in Garage Bay
H	New Jersey Pay For Performance Incentive Program
I	Photovoltaic (PV) Rooftop Solar Power Generation
J	Solar Thermal Domestic Hot Water Plant
K	Wind
L	EPA Portfolio Manager
M	Equipment Inventory & Lighting
N	Block Load Models

1.0 INTRODUCTION & BACKGROUND

The Ocean Gate Volunteer Fire Hall is a 3,483 square foot building located at 15 East Auburn Avenue. The building was constructed in 1949 and has not had any major renovations within recent years, with the exception of a new roof installed in 2009. The Fire Hall is comprised of a large, four bay garage, a men's and women's restroom on the first floor, and a lounge area on the second floor.

New Jersey's Clean Energy Program, funded by the New Jersey Board of Public Utilities, supports energy efficiency and sustainability for Municipal and Local Government Energy Audits. Through the support of a utility trust fund, New Jersey is able to assist state and local authorities in reducing energy consumption while increasing comfort.

2.0 EXECUTIVE SUMMARY

This report details the results of the Ocean Gate Volunteer Fire Hall, a 3,483 square foot building constructed in 1949. The Fire Hall includes a large four bay garage containing two fire engines, and men's and women's restroom on the first floor, and a lounge area on the second floor. The following areas were evaluated for energy conservation measures:

- Insulation upgrades
- Temperature setback
- Unit heaters replacement
- Lighting replacement
- Boiler replacement and hot water reset
- Garage door seal replacement

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $3,800 for the recommended ECMs may be realized with a payback of 3.4 years.

The ECMs identified in this report will allow for the building to reduce its energy usage and if pursued has the opportunity to qualify for the New Jersey SmartStart Buildings Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

ECM-1 Install Roof Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
3,200	0	0	670	1,000	5.2	NA	3.2	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-3 Temperature Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
900	0	0	1,250	1,900	31.0	NA	0.5	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-6 Install IR Heaters in Garage Bay

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
8,700	0.0	360	540	900	0.8	NA	9.8	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

3.0 EXISTING CONDITIONS

3.1 Building General

The Ocean Gate Volunteer Fire Hall was built in 1949 and consists primarily of concrete block. A new shingled roof was added in 2009. The roof is constructed of shingles and sheathing over trusses, and there is an attic space which is accessible from a hatch in the second floor ceiling. The attic space has about 1 inch of fiberglass insulation that has become matted down due to age.

The building's floor space is primarily utilized by the four bay garage. In the garage space, there are four 11'x11' motorized doors. Half of the garage is used for the two fire engines, and the other half for storage and various firefighting equipment, including a zodiac boat and an old classic fire engine. There is an air compressor in the southeast corner of the building used for filling air tanks and a desk area in the northeast corner of the building used for administrative work. Located off the garage area are men's, and women's restrooms. Across the hall from the restrooms is a staircase leading to the second floor, which consists of an approximately 1,000 square foot lounge with a large residential kitchen. The kitchen has a stove, microwave, and refrigerator. This area is used for meetings two to three times per week.

The building has very sporadic usage. There is no permanent staff, and fire fighters are activated as necessary, on an average about ten times per year. The volunteer fire fighters also use the building for training exercises. The building is used on average about eight times per month for several hours' duration.

3.2 Utility Usage

The fire hall meters electricity and gas usage. Water is provided at no charge by the borough. Electricity is provided by Jersey Central Power and Light, and natural gas by New Jersey Natural Gas.

Electricity usage data was available from January through December 2009; during that time the building consumed about 12,840 kWh of electricity at a cost of $2,900. Further analysis of the utility bills showed a supply unit cost of $.205 per kWh and $1.57 per kW. Combining these amounts provided a blended rate of $.229 per kWh. There is a noticeable increase in electricity consumption during the summer months when air conditioning equipment typically operates. The fire hall does not have central A/C; however, there is an approximately 1.5 ton in-wall unit located in the lounge area. The utility data suggests that this air conditioner is on for the majority of the summer. A graph showing electricity consumption can be viewed in Appendix A.

Gas usage was available for January 2009 through December 2009. Gas usage in the building consists of the boiler and a 40 gallon gas hot water heater. During this time period, about 3,520 therms of natural gas was consumed at a cost of $5,200. The cost of natural gas in 2009 was about $1.49 per therm. Natural gas usage was highest in the winter months when the building is in heating mode.

Electricity and natural gas commodity supply and delivery is presently purchased from JCP&L. The delivery component will always be the responsibility of the utility that connects the facility to the power grid or gas line; however, the supply can be purchased from a third party. The electricity or natural gas commodity supply entity will require submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical and natural gas energy commodity suppliers can be found in Appendix A.

The statewide average for commercial natural gas customers in the state of New Jersey was about $1.01/therm in 2009. If the DPW Building paid a rate closer to the statewide average, the facility would save about $1,700 per year. The commercial statewide average for electricity in 2009 for the state of New Jersey was about $0.144/kWh. If the building paid a rate closer to the statewide average the DPW Building would save about $1,100 per year.

3.3 HVAC Systems

The fire hall is heated by a 400 MBtu boiler located in a utility closet on the western side of the building. Heating hot water (HHW) is distributed throughout the building by a small circulating pump. Finned tube heaters are located in the restrooms and lounge. There are four unit heaters located in the garage, each with circulating fans that blow over hot water coils.

As noted previously, the building does not have central air conditioning, but the lounge has a large in-wall air conditioner that is approximately 1.5 tons.

3.4 Lighting/Electrical Systems

3.4.1 Interior Lighting

A comprehensive lighting survey was performed during the site visit. The building's lighting consists mainly of 4 foot T12 fixtures with magnetic ballasts. The bulbs are configured into 2-lamp fixtures in both the garage and upstairs lounge. The garage has a total of (10) 2-lamp T12 fixtures, and the upstairs lounge has (12) 2-lamp fixtures. The hallway which leads to the restrooms also has (2) T12 2-lamp fixtures. Both restrooms have single T12 fixture and a single 40 watt incandescent bulb. All lights inside the building are considered inefficient by today's standards.

3.4.2 Exterior Lighting

The front part of the building's exterior has (4) 14 watt compact fluorescent lights surrounding the main entrance. Additionally, there are two flagpoles that are each illuminated by one 100 W metal halide bulb. There are also four Par38 90 watt spotlights above the garage doors (one light above each door).

3.5 Control Systems

The boiler does not currently have a control system. As a result, water circulates throughout the building continuously. The lounge area has one manual thermostat to regulate temperature. In the garage, each unit heater is controlled by a manual thermostat. The day of the site visit, the temperature was in the 80s and the boiler was running.

3.6 Plumbing System

Domestic hot water for the building is provided by a 40 gallon A.O. Smith gas hot water heater located in the same utility closet as the boiler. The DHW heater has a rated output of 32,000 Btu/hr and provides 120°F water for the restrooms and the sink in the kitchen area.

The two restrooms each have one high flow sink and high flow toilet. However, the borough does not meter water usage in this facility; therefore, savings is not quantifiable. A small amount of water savings could be realized if these fixtures were replaced. But, the usage is so minimal that the replacement may not be economically feasible.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Install Roof Insulation

The roof of the building received an upgrade in 2009 with new shingles and new decking where needed. However, the insulation in the attic space was not upgraded during this renovation. The roof and ceiling are supported with rough cut lumber, and there is about one inch of fiberglass insulation in between the ceiling joists in the attic. The existing attic and roof have an approximate thermal resistance of R-6, which is very low compared with today's standards. This ECM proposes blowing about 8.5" of loose fiberglass insulation into the attic space which will increase thermal resistance to about R-36. Fiberglass insulation is recommended over cellulose because the R-value does not deteriorate as quickly with age.

To calculate the potential savings from adding insulation, the existing and proposed heat loss through the roof of the building was determined using the current and proposed R-values. These numbers were then compared with temperature bin data from Newark, NJ. The difference between these two values represents the savings that could be achieved with 8.5" added insulation. The resulting savings is about 670 therms of natural gas per year.

Roof insulation has a life expectancy of about 20 years according to manufacturer data. The total savings over the life of the project would be about 13,400 therms and $20,000.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Install Roof Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
3,200	0	0	670	1,000	5.2	NA	3.2	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

4.2 ECM-2 Boiler Replacement with Hot Water Temperature Reset

The Ocean Gate Fire Hall is heated with a 400 MBH boiler located in the mechanical room on the western side of the building. The boiler operates at an efficiency of about 80% and pipes hot water at 180°F throughout the building. The second floor and restroom areas have finned tube heaters, and the garage space has four hot water unit heaters. This ECM proposes replacing the existing boiler with a high efficiency gas fired condensing boiler with hot water temperature reset.

Condensing boilers can reach efficiencies of about 95% because they are able to extract additional heat from the combusted flue gases with the addition of a heat exchanger in the exhaust air flow. Hot water temperature reset is achieved with temperature control sensors that monitor outdoor air temperature and modulate the supply heating hot water temperature. When it is warmer outside, the building does not always need 180°F water for heating, so a controller can reduce the load on the boiler.

To calculate the savings for a new boiler, a block load model of the building was created to determine the building heating loads. The block load, which can be viewed in Appendix N, takes into account roof and

wall insulation values, building infiltration, occupancy, and other sources of building heat gains and losses. After gaining an understanding of building heating loads using the block load model, the existing and proposed boilers were analyzed using temperature bin data from Newark, NJ. By installing a new boiler, the building is expected to save about 320 therms of natural gas per year.

To calculate the hot water setback temperature savings, a spreadsheet was created which compared building heating needs to outdoor temperature bin data from Newark, NJ. It was assumed that when a minimal amount of heating is called for in the building, the boiler water temperature can be set back to 140°F. The temperature is expected to increase linearly up to 180°F as building heating requirements rise. The savings that could be achieved with this hot water staging would save a conservative 10 therms per year. In total, this ECM would save about 330 therms of natural gas per year.

Condensing boilers have a life expectancy of about 24 years according to ASHRAE. The savings over the life of the project would be about 7,920 therms and $12,000.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
13,400	0	0	330	500	(0.1)	700	>25	>25

* Incentive is shown per 2010 New Jersey Smart Start Program's Gas Heating Equipment Incentives

This measure is not recommended.

4.3 ECM-3 Temperature Setback

The temperature in the building is controlled by multiple manual thermostats; one thermostat on the second floor and four in the garage area. Each thermostat controls a hot water heating unit which uses a fan to blow over hot water coils. The building temperature is currently set at about 70°F in the winter during occupied and unoccupied times. The building is only used an average of eight hours per week, and significant savings could be realized if the temperature was decreased to 60°F during unoccupied times. To allow for temperature setback, a central programmable thermostat would need to be installed to control the usage of the boiler.

To calculate the proposed savings associated with installing a programmable thermostat to regulate temperature setback, the block load model from the previous ECM was used. The temperature setpoints of the block load were changed from the existing conditions to the proposed conditions with a programmable thermostat to obtain an accurate representation of the expected savings. The calculated savings that could be obtained from setting the temperature back from 70°F to 60°F during unoccupied times would be about 1,250 therms of natural gas per year.

Programmable thermostats have an approximate life expectancy of 15 years according to ASHRAE. The total savings over the life of the project would be about 18,750 therms and $28,500.

The implementation cost and savings related to this ECM are presented in Appendix D and summarized below:

ECM-3 Temperature Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
900	0	0	1,250	1,900	31.0	NA	0.5	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

4.4 ECM-4 Install Garage Door Seals

The Ocean Gate Fire Hall has four insulated garage doors that are each 11' x 11'. The doors are closed for most of the year; however, during the site visit light was emanating from the bottom of the doors into the garage space. This is an indication of poorly sealed doors, which results in excess infiltration of air into the building. This ECM assesses the benefits of replacing the garage door seals.

To calculate the savings for this ECM, the existing garage door infiltration was compared with the proposed infiltration through doors with new seals. Based on the field inspection, it was determined that the bottoms of the doors have an infiltration rate of about 0.4 CFM per linear foot. With new seals, the infiltration rate is expected to be about 0.15 CFM per linear foot. The difference between the infiltrations would result in a savings of about 11 CFM of air, and at the current boiler efficiency of about 80% this would save about 20 therms of natural gas per year.

This measure was evaluated, and the savings were less than $100; therefore, it is not recommended as part of the study. However, it is a low cost measure with an attractive payback, and implementation may be desired for occupant comfort. See Appendix E for calculations.

Door seals have an expected life of 10 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 230 therms, totaling $300.

4.5 ECM-5 Replace T-12 Lights

A lighting survey was performed, consisting of an overall count, analysis of current lighting types, and potential replacement options for increased energy efficiency. It should be noted that the individual men's and women's restrooms each have two types of light fixtures. The survey determined that the lighting could be upgraded in the following areas of the building:

Building Area	Number of fixtures	Existing Fixtures	Proposed Fixtures
Garage Area	10	T12, magnetic ballast	T8, electronic ballast
Upstairs Lounge	12	T12, magnetic ballast	T8, electronic ballast
Men's Restroom	1	T12, magnetic ballast	T8, electronic ballast
Women's Restroom	1	T12, magnetic ballast	T8, electronic ballast
Men's Restroom	1	40 W incandescent	13 W compact fluorescent
Women's Restroom	1	40 W incandescent	13 W compact fluorescent

To calculate the savings that could be achieved by replacing these lights, the existing wattage of all the lighting was multiplied by the total amount of time the lights are on. The proposed lighting wattages were then summed and multiplied by the same number of hours. It was determined that the lighting measure would save about 230 kWh per year.

Lighting has an expected lifespan of 15 years according to lighting manufacturers. The total energy savings over the life of the project would be 10,050 kWh and $1,500.

The implementation cost and savings related to this ECM are presented in Appendix F and summarized below:

ECM-5 Replace T12 Lights

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		therms	Total	ROI			
$	kW	kWh	Natural Gas	$		$ -	Years	Years
2,200	0.5	3,450	0	100	(0.7)	400	22.0	18.0

* Incentive shown is per the 2010 New Jersey Smart Start Program's Prescriptive Lighting Application.

This measure is not recommended.

4.6 ECM-6 Install IR Heaters in Garage Bay

The garage bay area is heated by four hot water unit heaters that are on the hot water boiler loop. These heaters operate at the same efficiency as the boiler, which is 80%. This ECM proposes capping off the hot water lines going to the garage heaters, removing the heaters, and replacing them with gas fired infrared heaters. IR heaters perform well in garage settings because they heat the objects in the garage by means of radiant heat as opposed to unit heaters which use fans to blow hot air throughout the building. Because of this, IR heaters have an effectiveness of 100%, compared to a unit heater's effectiveness of about 80%. Effectiveness is a ratio of the heat produced compared to the actual heat that reaches the floor space. Additionally, IR heaters are about 85% efficient, a 5% increase from the current unit heat efficiency.

To calculate the savings that could be realized from replacing the hot water heaters, the differences in effectiveness and efficiencies between the existing unit heaters and the IR heaters were compared to temperature bin data from Newark, NJ. With higher efficiencies and better effectiveness, the fire hall can be expected to save about 540 therms of natural gas per year. Additionally, there would be a 360 kWh savings by switching to IR heaters because the fan used by the unit heaters to blow hot air into the room would be eliminated.

IR heaters have an expected lifespan of 18 years according to ASHRAE. The total energy savings over the life of the project would be 9,720 therms, 6,480 kWh, and $16,200.

The implementation cost and savings related to this ECM are presented in Appendix F and summarized as follows:

ECM-6 Install IR Heaters in Garage Bay

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
8,700	0.0	360	540	900	0.8	NA	9.8	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

The building will be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives will be from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities whose demand in any of the preceding 12 months exceeds 200 kW. However, the 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. American Recovery and Reinvestment Act (ARRA) funding, when available, may allow oil, propane and municipal electric customers to be eligible for the P4P Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy saving and designed to pay approximately 60% of the total performance-based incentive. Base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool. Incentive #3 base incentives deliver $0.07/kWh and $0.70/therm not to exceed 20% of total project cost.

Combining incentives #2 and #3 will provide a total of $0.18/ kWh and $1.80/therm not to exceed 50% of total project cost. Additional incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

5.1.2 New Jersey Smart Start Program

For this program, specific incentives for energy conservation measures are calculated on an individual basis utilizing the 2010 New Jersey Smart Start incentive program. This program provides incentives dependent upon mechanical and electrical equipment. If applicable, incentives from this program are reflected in the ECM summaries and attached appendices.

If the building qualifies and enters into the New Jersey Pay for Performance Program, all energy savings will be included in the total building energy reduction, and savings will be applied towards the Pay for Performance incentive. A project is not applicable for both New Jersey incentive programs.

5.1.3 Energy Efficient and Conservation Block Grant

The following is a brief summary of the Energy Efficient and Conservation Block Grant (EECBG) program. The Energy Efficiency and Conservation Block Grant Complete Program Application Package should be consulted for rules and regulations.

Additional funding is available to local government entities through the EECBG, a part of New Jersey's Clean Energy program (NJCEP). The grant is for local government entities only, and can offset the cost of energy reduction implementation to a maximum of $20,000 per building.

This program is provided in conjunction with NJCEP funding and any utility incentive programs; the total amount of the three incentives combined cannot exceed 100% of project cost. Funds shall first be provided by NJCEP, followed by the EECBG and any utility incentives available to the customer. The total amount of the incentive shall be determined TRC Solutions, a third party technical consulting firm for the NJCEP.

In order to receive EECBG incentives, local governments must not have received a Direct Block Grant from the US Department of Energy. A list of the 512 qualifying municipalities and counties is provided on the NJCEP website. Qualifying municipalities must participate in at least one eligible Commercial & Industrial component of the NJCEP, utility incentive programs, or install building shell measures recommended by the Local Government Energy Audit Program. Eligible conservation programs through NJCEP include:

- Direct Install
- Pay for Performance
- NJ SmartStart Buildings for measures recommended by a Local Government Energy Audit (LGEA) or an equivalent audit completed within the last 12 months
- Applicants may propose to independently install building shell measures recommended by a LGEA or an equivalent audit. The audit must have been completed within the past 12 months.
- Any eligible utility energy efficiency incentive program

Most facilities owned or leased by an eligible local government within the State of New Jersey are eligible for this grant. Ineligible facilities include casinos or other gambling establishments, aquariums, zoos, golf courses, swimming pools, and any building owned or leased by the United States Federal Government. New construction is also ineligible.

5.1.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

The American Recovery and Reinvestment Act (ARRA) Initiative is available to New Jersey oil, propane, cooperative and municipal electric customers who do not pay the Societal Benefits Charge. This charge can be seen on any electric bill as the line item "SBC Charge." Applicants can participate in this program in conjunction with other New Jersey Clean Energy Program initiatives including Pay for Performance, Local Government Energy Audits, and Direct Install programs.

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount

of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

Additional information is available on New Jersey's Clean Energy Program website.

5.1.5 Direct Install Program

The Direct Install Program targets small and medium sized facilities where the peak electrical demand does not exceed 200 kW in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. On a case-by-case basis, the program manager may accept a project for a customer that is within 10% of the 200 kW peak demand threshold.

The 200 kW peak demand threshold has been waived for local government entities that receive and utilize their Energy Efficiency and Conservation Block Grant as discussed in section 5.1.3 in conjunction with Direct Install.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 60% of the costs for lighting, HVAC, motors, natural gas, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can significantly reduce the implementation cost of energy conservation projects.

The program pays a maximum amount of $50,000 per building, and up to $250,000 per customer per year. Installations must be completed by a Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website at http://www.njcleanenergy.com. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this document.

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

The building is eligible for all three incentives available from the New Jersey P4P program. Incentive #1 is for the development of an energy reduction plan and will pay $.05/ square foot of the building footprint, which equates to about $200. Implementation of the energy conservation measures discussed in this report is expected to reduce the building's energy usage by over 15% which qualifies it for both incentives #2 and #3. Combining incentives #2 and #3 will provide maximum savings of $0.18/ kWh and $1.80/ therm not to exceed 50% of the total project cost. The building is projected to save about 550 kWh of electricity which amounts to about $100 in incentives. The building is also projected to save about 2,270 therms of natural gas. With New Jersey's current incentive structure, this would qualify for about $4,100 in incentive money. Combining all incentives in the P4P program would amount to approximately $4,200, reducing the overall payback of the project from 9.8 years to 8.3 years if all ECMs were implemented. See Appendix H for calculations.

5.2.2 New Jersey Smart Start Program

The Ocean Gate Volunteer Fire Hall is eligible for two incentives from the New Jersey Smart Start Program.

The boiler replacement ECM is eligible for about $700 in incentive money for being at least 85% efficient, and the lighting replacement measure is eligible for $400 in savings if all fixtures are replaced. Totaling all these incentives would produce a savings of about $1,100.

5.2.3 Energy Efficient and Conservation Block Grant

The fire hall is owned by local government which makes it eligible for this incentive. The incentive amount is determined by TRC Solutions and is not calculable at this time. Further information about this incentive, including the application, can be found at:
http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants

5.2.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

The fire hall pays the Societal Benefits charge and is therefore not eligible for the ARRA Initiative Incentive.

5.2.5 Direct Install Program

The Fire Hall will be eligible to receive funding from the Direct Install Program. This money will be in conjunction with the Energy Efficiency and Conservation Block Grant. The total implementation cost for all ECMs in the Fire Hall is about $28,800. This program would pay 60%, or about $17,300 of these initial costs. This funding has the potential to significantly affect the payback periods of Energy Conservation Measures. For the Fire Hall, the Direct Install Program brings the simple payback from about 6.7 years, to approximately 2.7 years.

In order to apply for this program the borough must contact the Direct Install contractor for Ocean County, Hutchinson Mechanical Services. Contact information is available on the New Jersey Clean Energy Website.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 Geothermal

Geothermal heat pumps (GHP) transfer heat between the constant temperature of the earth and the building to maintain the building's interior space conditions. Below the surface of the earth throughout New Jersey the temperature remains in the low 50°F range throughout the year. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. With GHP systems, water is circulated between the building and the piping buried in the ground. The ground heat exchanger in a GHP system is made up of a closed or open loop pipe system. Most common is the closed loop in which high density polyethylene pipe is buried horizontally at 4-6 feet deep or vertically at 100 to 400 feet deep. These pipes are filled with an environmentally friendly antifreeze/water solution that acts as a heat exchanger. In the summer, the water picks up heat from the building and moves it to the ground. In the winter the system reverses and fluid picks up heat from the ground and moves it to the building. Heat pumps make collection and transfer of this heat to and from the building possible.

The building uses a gas-fired, hot water boiler and a window AC unit to meet the HVAC requirements. With exception to the hydronic heating system, most of the existing equipment is not compatible with a geothermal energy source. Therefore, to take advantage of a GHP system, the existing mechanical equipment would have to be removed or overhauled; and either a low temperature closed loop water source heat pump system or a water to water heat pump system would have to be installed to realize the benefit of the consistent temperature of the ground.

This measure is not recommended due to the extent of HVAC system renovation needed for implementation. Additionally, the building's minimal heating requirements do not justify such an extensive renovation and the project would not payback within the useful life of the equipment.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The fire hall was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The building's roof has sufficient room to install a solar cell array but it would need to be angled south for maximum efficiency. A structural analysis would be required to determine if the roof framing could support a cell array.

The PVWATTS solar power generation model was utilized to calculate PV power generation. The New Jersey Clean Power Estimator provided by the New Jersey Clean Energy Program is presently being updated; therefore, the site recommended use of the PVWATT solar grid analyzer version 1. The closest city available in the model is Newark, New Jersey and a fixed tilt array type was utilized to calculate energy production. The PVWATT solar power generation model is provided in Appendix J.

The State of New Jersey incentives for non-residential PV applications is $0.75/watt up to 30 kW of installed PV array. Projects up to 50 kW are eligible to apply. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes and would not be able to utilize the federal tax credit incentive.

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for periods of 15 years from the date of installation. The cost of the ACP penalty for 2009 was $700; this is the amount that must be paid per SERC by the high emission producers. The expected dollar amount that will be paid to the PV producer for 2010 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

The building had a maximum electricity demand of 17.1 kW and a minimum of 12.0 kW, over the previous 12 months. The monthly average over the observed 12 month period was 13.6 kW. The existing load does not justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 16 kW system size was selected for the calculations. The system costs for PV installations were derived from the most recent NYSERDA (New York State Energy Research and Development Agency) estimates of total cost of system installation. It should be noted that the cost of installation is approximately $8 per watt or $8,000 per kW of installed system. This has increased in the past few years due to the rise in national demand for PV power generator systems. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

The implementation cost and savings related to this ECM are presented in Appendix J and summarized below:

Photovoltaic (PV) Rooftop Solar Power Generation – 16 kW System

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive*	New Jersey Renewable SREC**	Payback (without incentive)	Payback (with incentives)
	Electricity		Natural Gas	Total					
$	kW	kWh	Therms	$	$	$	$	Years	Years
128,000	0	18,900	0	4,300	4,300	12,000	9,200	>25	8.6

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $0.75 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

The fire hall does have some southern facing roof area, but there is not enough to hold a 16 kW solar array. Solar cells work best when they are south facing, with no surrounding obstructions (mostly trees and other buildings) that could cast shadows over the panels. There is very little open land area around the fire hall for arrays to be built.

While the payback period is within the parameters for recommended measures, further investigation of possible installation locations, required system maintenance, and local installation costs are suggested prior to consideration for implementation.

6.2.2 Solar Thermal Hot Water Plant

Active solar thermal systems use solar collectors to gather the sun's energy to heat water, other fluids, or air. An absorber in the collector converts the sun's energy into heat. The heat is then transferred by circulating water, antifreeze, or sometimes air to another location for immediate use or storage for later utilization. Applications for active solar thermal energy include providing hot water, heating swimming pools, space heating, and preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, a heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted around the site's latitude, to maximize the amount of radiation collected on a yearly basis.

Several options exist for using active solar thermal systems for space heating. The most common method involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system). The most practical system would transfer the heat from the panels to thermal storage tanks and transfer solar produced thermal energy to use for domestic hot water production. DHW is presently produced by a gas water heater, and a solar DHW system would save natural gas.

Currently, an incentive is not available for installation of thermal solar systems. A Federal tax credit of 30% of installation cost for the thermal applications is available; however, Ocean Gate does not pay federal taxes and, therefore, would not benefit from this program.

This measure is not recommended for the fire hall.

6.3 Wind

Small wind turbines use a horizontal axis propeller, or rotor, to capture the kinetic energy of the wind and convert it into rotary motion to drive a generator which usually is designed specifically for the wind turbine. The rotor consists of two or three blades, usually made from wood or fiberglass. These materials give the turbine the needed strength and flexibility, and have the added advantage of not interfering with television signals. The structural backbone of the wind turbine is the mainframe, and includes the slip-rings that connect the wind turbine, which rotates as it points into changing wind directions, and the fixed tower wiring. The tail aligns the rotor into the wind.

To avoid turbulence and capture greater wind energy, turbines are mounted on towers. Turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller turbines can utilize shorter towers. For example, a 250-watt turbine may be mounted on a 30-50 foot tower, while a 10 kW turbine will usually need a tower of 80-120 feet. Tower designs include tubular or latticed, guyed or self-supporting. Wind turbine manufacturers also provide towers.

The New Jersey Clean Energy Program for small wind installations has designated numerous pre-approved wind turbines for installation in the State of New Jersey. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Systems sized under 16,000 kWh per year of production will receive a $3.20 per kWh incentive. Systems producing over 16,000 kWh will receive $51,200 for the first 16,000 kWh of production with an additional $0.50 per kWh up to a maximum cap of 750,000 kWh per year. Federal tax credits are also available for renewable energy projects up to 30% of installation cost for systems less than 100 kW. However, as noted previously, municipalities do not pay federal taxes and are not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the Ocean Gate Borough area, the map shown in the appendices indicates a mean annual wind speed of about 12.8 mph. For the building, there are site restrictions, such as parking lots, trees and surrounding structures would greatly affect a tower location.

A wind speed map and aerial site photo are included in Appendix K.

The borough already has one wind turbine on its premises with another turbine wind turbine that is planned to go up. The coastal area of New Jersey is optimal for turbines because of the high average wind speed.

6.4 Combined Heat and Power Generation (CHP)

Combined heat and power, cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The building does not have an excessively large electricity demand, and it does not have a heating load to use the thermal byproduct in the summer. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. Purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

This measure is not recommended.

6.5 Biomass Power Generation

Biomass power generation is a process in which waste organic materials are used to produce electricity or thermal energy. These materials would otherwise be sent to the landfill or expelled to the atmosphere. To participate in NJCEP's Customer On-Site Renewable Energy program, participants must install an on-site sustainable biomass or fuel cell energy generation system. Incentives for bio-power installations are available to support up to 1MW-dc of rated capacity.

*Class I organic residues are eligible for funding through the NJCEP CORE program. Class I wastes include the following renewable supply of organic material:

- Wood wastes not adulterated with chemicals, glues or adhesives
- Agricultural residues (corn stover, rice hulls or nut shells, manures, poultry litter, horse manure, etc) and/or methane gases from landfills
- Food wastes
- Municipal tree trimming and grass clipping wastes

- Paper and cardboard wastes
- Non adulterated construction wood wastes, pallets

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

- Digestion of sewage sludge
- Landfill gas facilities
- Combustion of wood wastes to steam turbine
- Gasification of wood wastes to reciprocating engine
- Gasification or pyrolysis of bio-solid wastes to generation equipment

* from NJOCE Website

This measure is not recommended due to the extent of HVAC system renovation needed for implementation. Additionally, the building's minimal heating requirements do not justify such an extensive renovation and the project would not payback within the useful life of the equipment.

6.6 Demand Response Curtailment

Utility Curtailment is an agreement with the regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and incentives are offered to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or emergencies. Part of the program also will require that participants reduce their required load or run emergency generators with notice to test the system.

JCP&L does not currently have a Demand Response Curtailment, or Load shedding program for its customers so this is not an option for the fire hall.

7.0 EPA PORTFOLIO MANAGER

The United State Environmental Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The program is designed to allow property owners and managers to share, compare and improve upon their facility's energy consumption. Inputting such parameters as electricity, heating fuel, building characteristics and location into the website based program generates a naturalized energy rating score out of 100. Once an account is registered, monthly utility data can be entered to track the savings progress and retrieve an updated energy rating score on a monthly basis.

The fire hall is considered a high energy consumer by the Portfolio Manager with a Site Energy Usage Index (EUI) of 114 kBTU/ft^2/year. Several factors contribute to the unfavorable EUI, including, but not limited to, wasted energy from poor wall insulation, higher than necessary temperature setpoints, and inefficient lighting. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 48 kBTU/ft^2/year; the national average for this building type is 78 kBTU/ft^2/year. The EPA Portfolio Manager was unable to generate an energy rating score for this building because the utility data provided was over 120 days old. This number represents how energy efficient a building is on a scale from 1 to 100 with 100 being the best. In order for a building to receive and energy star label, this energy benchmark rating must be at least 75. As energy use decreases from the implementation of the proposed ECMs, this rating will increase.

A full EPA Energy Star Portfolio Manager Report is located in Appendix L.

The user name and password for the EPA Portfolio Manager Account has been provided to Paulette Konopka, the Ocean Gate Chief Financial Officer.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Ocean Gate Volunteer Fire Hall, in Ocean Gate, New Jersey identified potential ECMs for insulation upgrades, temperature setback, and unit heaters replacement. . Potential annual savings of $3,800 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Install Roof Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
3,200	0	0	670	1,000	5.2	NA	3.2	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-3 Temperature Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
900	0	0	1,250	1,900	31.0	NA	0.5	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-6 Install IR Heaters in Garage Bay

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
8,700	0.0	360	540	900	0.8	NA	9.8	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

APPENDIX A

Utility Usage Analysis

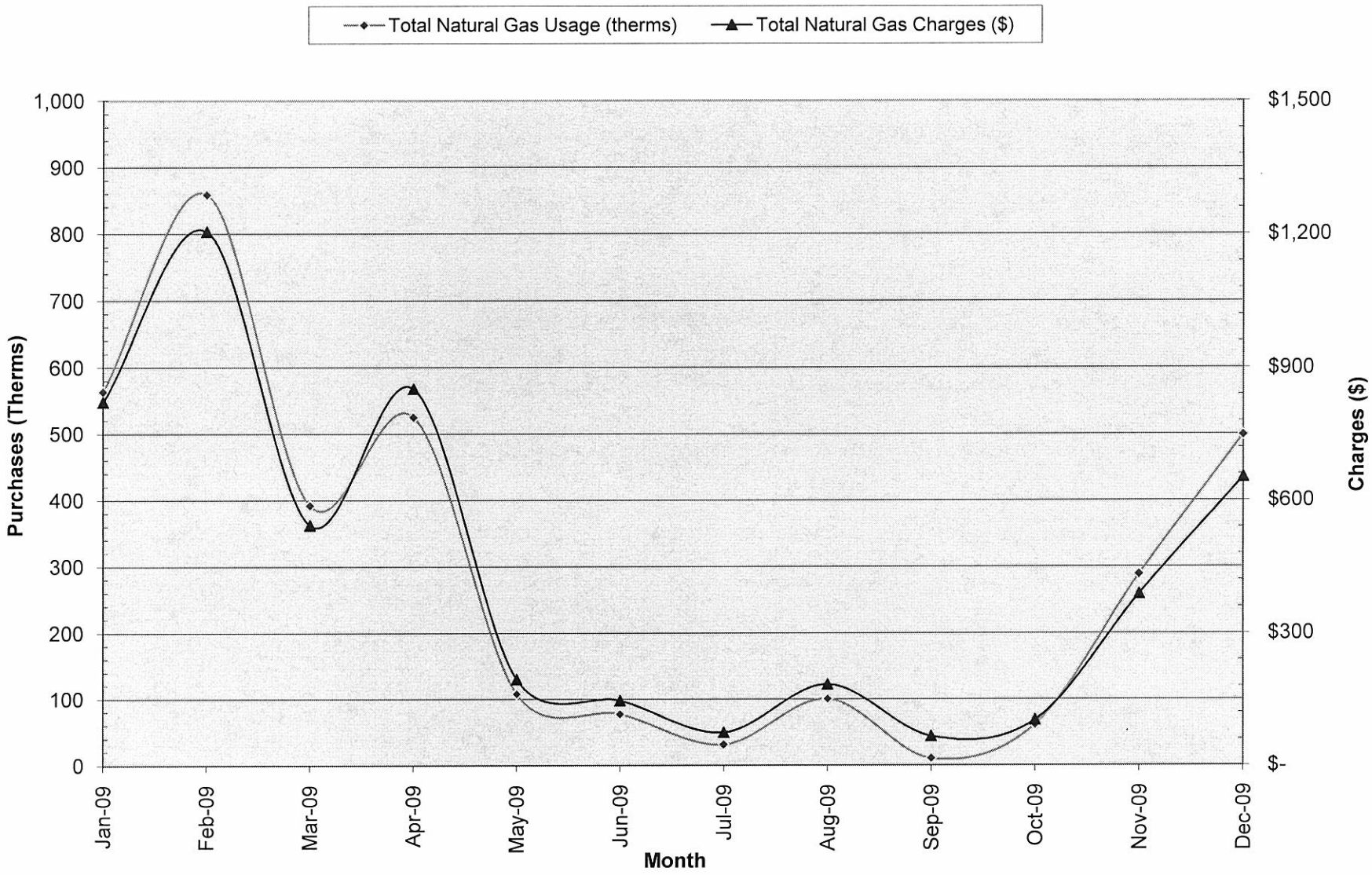
New Jersey BPU Energy Audit Program
CHA Project Number: 21611
Ocean Gate Fire Hall
New Jersey Natural Gas

151 E Longport Ave
Account Number: 16-4672-0280-12

Month	Therms	Charges ($)	($/therm)
January-09	564	$ 822.17	$ 1.46
February-09	859	$ 1,204.93	$ 1.40
March-09	392	$ 543.60	$ 1.39
April-09	525	$ 851.70	$ 1.62
May-09	108	$ 195.12	$ 1.80
June-09	77	$ 146.84	$ 1.90
July-09	31	$ 74.45	$ 2.37
August-09	100	$ 183.90	$ 1.83
September-09	10	$ 66.08	$ 6.32
October-09	62	$ 102.88	$ 1.67
November-09	289	$ 388.10	$ 1.34
December-09	499	$ 652.65	$ 1.31

Total	3,518	$ 5,232	$ 1.49
Most Recent Yr	3,518	$ 5,232	$ 1.49

Natural Gas Usage - Fire Hall



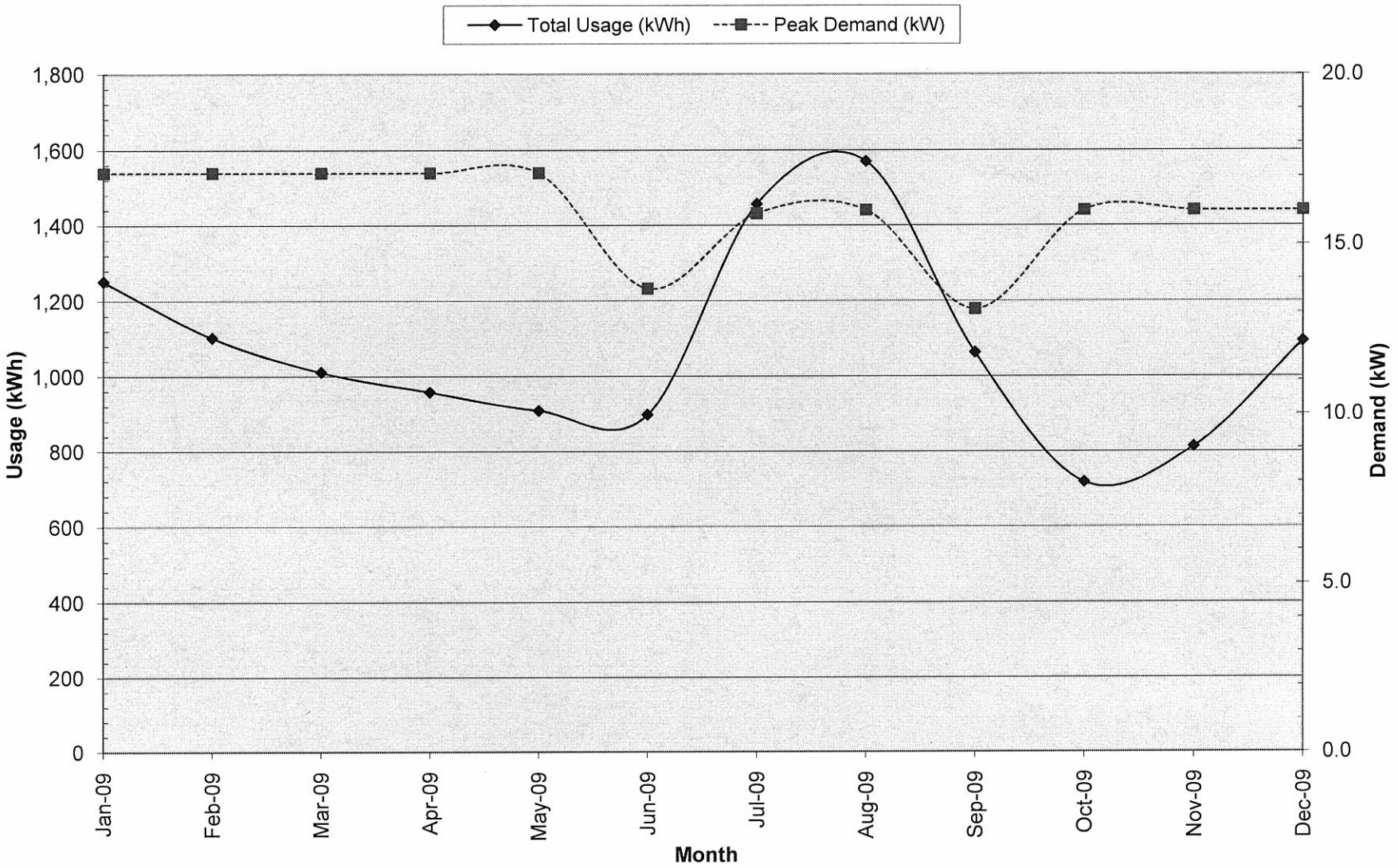
Utility Data - Ocean Gate Fire Hall
Natural Gas Chart

New Jersey BPU Energy Audit Program
CHA Project Number: 21611
Ocean Gate Fire Hall
JCP&L - Electric Service

151 E Longport Ave
Account Number: 100051044095

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-09	1,252	17.1	$267.76	$22.44	$245.32	0.2139	0.1959	1.31
February-09	1,102	17.1	$246.55	$22.44	$224.11	0.2237	0.2034	1.31
March-09	1,011	17.1	$230.81	$22.44	$208.37	0.2283	0.2061	1.31
April-09	958	17.1	$219.72	$22.44	$197.28	0.2294	0.2059	1.31
May-09	909	17.1	$210.27	$22.44	$187.83	0.2313	0.2066	1.31
June-09	898	13.7	$230.59	$25.68	$204.91	0.2568	0.2282	1.87
July-09	1,456	15.9	$338.35	$40.95	$297.40	0.2324	0.2043	2.58
August-09	1,570	16.0	$356.97	$41.64	$315.33	0.2274	0.2008	2.60
September-09	1,063	13.1	$238.35	$21.51	$216.84	0.2242	0.2040	1.64
October-09	718	16.0	$169.00	$20.16	$148.84	0.2354	0.2073	1.26
November-09	813	16.0	$187.23	$20.16	$167.07	0.2303	0.2055	1.26
December-09	1,094	16.0	$240.75	$20.16	$220.59	0.2201	0.2016	1.26
Total	12,844	17.1	$2,936.35	$302.46	$2,633.89	0.2286	0.2051	1.57
Most Recent Yr	12,844	17.1	$2,936.35	$302.46	$2,633.89	0.2286	0.2051	1.57

Electric Usage - Ocean Gate Fire Hall



Utility Data - Ocean Gate Fire Hall
Electricity Chart

ELECTRIC MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell electricity to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

American Powernet Management
867 Berkshire Blvd, Suite 101
Wyomissing, PA 19610
www.americanpowernet.com

BOC Energy Services
575 Mountain Avenue
Murray Hill, NJ 07974
www.boc-gases.com

Commerce Energy Inc.
535 Route 38, Suite 138
Cherry Hill, NJ 08002
(888) 817-8572 or
(858) 910-8099
www.commerceenergy.com

ConEdison Solutions
701 Westchester Avenue
Suite 201 West
White Plains, NY 10604
(800) 316-8011
www.ConEdSolutions.com

Constellation NewEnergy, Inc.
1199 Route 22 East
Mountainside, NJ 07092
908 228-5100
www.newenergy.com

Credit Suisse (USA), Inc.
700 College Road East
Princeton, NJ 08450
www.creditsuisse.com

Direct Energy Services, LLC
One Gateway Center, Suite 2600
Newark, NJ 07102
(973) 799-8568
www.directenergy.com

FirstEnergy Solutions
395 Ghent Road Suite 407
Akron, OH 44333
(800) 977-0500
www.fes.com

Gerdau Ameristeel Energy Co.
North Crossman Road
Sayreville, NJ 08872

Gexa Energy LLC New Jersey
20 Greenway Plaza, Suite 600
Houston, TX 77046
(866) 304-GEXA
Beth.miller@gexaenergy.com

Glacial Energy of New Jersey
2602 McKinney Avenue, Suite 220
Dallas, TX 75204
www.glacialenergy.com

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
www.hess.com

Integrys Energy Services, Inc
99 Wood Avenue, Suite 802
Iselin, NJ 08830
www.integrysenergy.com

Liberty Power Delaware, LLC
1901 W Cypress Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Liberty Power Holdings, LLC
1901 W Cypress Creek Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Pepco Energy Services, Inc.
d/b/a Power Choice
23 S. Kinderkamack Rd Ste D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
http://www.pplenergyplus.com/

Sempra Energy Solutions
The Mac-Cali Building
581 Main Street, 8th Floor
Woodbridge, NJ 07095
(877) 273-6772
www.SempraSolutions.com

South Jersey Energy Company
1 South Jersey Plaza, Route 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com

Strategic Energy, LLC
6 East Main Street, Suite 6E
Ramsey, NJ 07446
(888) 925-9115
www.sel.com

Suez Energy Resources NA
333 Thornall Street FL6
Edison, NJ 08818
866.999.8374(toll free)
www.suezenergyresources.com

UGI Energy Services, Inc.
d/b/a POWERMARK
1 Meridian Blvd. Suite 2C01
Wyomissing, PA 19610
(800) 427-8545
www.ugienergyservices.com

Jan 14, 2009

GAS MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell natural gas to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

Gateway Energy Services
44 Whispering Pines Lane
Lakewood, NJ 08701
(800) 805-8586
www.gesc.com

Metro Energy Group, LLC
14 Washington Place
Hackensack, NJ 07601
www.metroenergy.com

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

Great Eastern Energy
3044 Coney Island Ave. PH
Brooklyn, NY 11235
888-651-4121
www.greateasterngas.com

Metromedia Energy, Inc.
6 Industrial Way
Eatontown, NJ 07724
(800) 828-9427
www.metromediaenergy.com

South Jersey Energy Company
One South Jersey Plaza, Rte 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com/sje.htm

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
(800) 437-7872
www.hess.com

Mitchell- Supreme Fuel
(NATGASCO)
532 Freeman Street
Orange, NJ 07050
(800) 840-4GAS
www.mitchellsupreme.com

Sprague Energy Corp.
Two International Drive, Ste 200
Portsmouth, NH 03801
800-225-1560
www.spragueenergy.com

Hudson Energy Services, LLC
545 Route 17 South
Ridgewood, NJ 07450
(201) 251-2400
www.hudsonenergyservices.com

MxEnergy Inc.
P.O. Box 177
Annapolis Junction, MD 20701
800-375-1277
www.mxenergy.com

Stuyvesant Energy LLC
642 Southern Boulevard
Bronx, NY 10455
(718) 665-5700
www.stuyfuel.com

Intelligent Energy
7001 SW 24th Avenue
Gainesville, FL 32607
Sales: 1 877 I've Got Gas
(1 877 483-4684)
Customer Service:
1 800 927-9794
www.intelligentenergy.org

Pepco Energy Services, Inc.
23 S Kinderkamack Rd, Suite D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

Tiger Natural Gas, Inc.
1422 E. 71st Street, Suite J.
Tulsa, OK 74136
1-888-875-6122
www.tigernaturalgas.com

Systrum Energy
877-SYSTRUM
(877-797-8786)
www.systrumenergy.com

Plymouth Rock Energy, LLC
165 Remsen Street
Brooklyn, NJ 11201
866-539-6450
www.plymouthrockenergy.com

UGI Energy Services, Inc.
d/b/a GASMARK
704 E. Main Street, Suite I
Moorestown, NJ 08057
856-273-9995
www.ugienergyservices.com

Macquarie Cook Energy, LLC
10100 Santa Monica Blvd, 18th
Fl
Los Angeles, CA 90067

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
www.pplenergyplus.com/natural+gas/

Woodruff Energy
73 Water Street
P.O. Box 777
Bridgeton, NJ 08302
(856) 455-1111
www.woodruffenergy.com

APPENDIX B

ECM-1 Install Roof Insulation

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 1 Install Roof Insulation

Existing Roof Area	2,425	sf
Existing U-value	0.17	Btu/hr/(sf*F)
Proposed R-value	36	
Proposed U-value	0.03	Btu/hr/(sf*F)
Heating System Efficiency	80%	
Cooling System Efficiency	0.00	kW/ton

Existing Cooling		
Existing Cooling Load Temp Diff.	73	F
Existing Max. Roof Cooling Load	29,811	Btu/hr
Proposed Cooling		
Proposed Cooling Load	4,926	Btu/hr
Occupied Cooling Setpoint	74	F
Unoccupied Cooling Setpoint	80	F

Existing Heating		
Existing Heating Load Temp Diff.	66	F
Existing Max. Roof Heating Load	26,748	Btu/hr
Occupied Heating Setpoint	70	F
Unoccupied Heating Setpoint	70	F
Proposed Heating		
Proposed Heating Load	4,420	Btu/hr

Existing Heating Total	64,319,334	Btu/yr
Proposed Heating Total	10,627,917	Btu/yr
Savings	53,691,417	Btu/yr
Input	671	**therms**
Existing Cooling Total	-	kWh/yr
Proposed Cooling Total	-	kWh/yr
Savings	-	kWh/yr

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	**Existing Equipment Bin Hours**	**Occupied Equipment Bin Hours**	**Unoccupied Equipment Bin Hours**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Cooling Load**	**Existing Heating Load**	**Proposed Cooling Load**	**Proposed Heating Load**
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
102.5	0	0	0	11,638	1,923	-	-	9,188	1,518	-	-	-	-	-	-
97.5	3	0	3	9,597	1,586	-	-	7,146	1,181	-	-	-	-	-	-
92.5	34	2	32	7,555	1,248	-	-	5,105	843	-	-	-	-	-	-
87.5	131	6	125	5,513	911	-	-	3,063	506	-	-	-	-	-	-
82.5	500	24	476	3,471	574	-	-	1,021	169	-	-	-	-	-	-
77.5	620	30	590	1,429	236	-	-	-	-	-	-	-	-	-	-
72.5	664	32	632	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	41	813	-	-	1,021	169	-	-	1,021	169	-	871,857	-	144,063
62.5	927	44	883	-	-	3,063	506	-	-	3,063	506	-	2,839,149	-	469,132
57.5	600	29	571	-	-	5,105	843	-	-	5,105	843	-	3,062,728	-	506,075
52.5	610	29	581	-	-	7,146	1,181	-	-	7,146	1,181	-	4,359,283	-	720,314
47.5	611	29	582	-	-	9,188	1,518	-	-	9,188	1,518	-	5,613,981	-	927,636
42.5	656	31	625	-	-	11,230	1,856	-	-	11,230	1,856	-	7,366,882	-	1,217,280
37.5	1,023	49	974	-	-	13,272	2,193	-	-	13,272	2,193	-	13,577,074	-	2,243,431
32.5	734	35	699	-	-	15,314	2,530	-	-	15,314	2,530	-	11,240,213	-	1,857,296
27.5	334	16	318	-	-	17,355	2,868	-	-	17,355	2,868	-	5,796,724	-	957,832
22.5	252	12	240	-	-	19,397	3,205	-	-	19,397	3,205	-	4,888,114	-	807,696
17.5	125	6	119	-	-	21,439	3,543	-	-	21,439	3,543	-	2,679,887	-	442,816
12.5	47	2	45	-	-	23,481	3,880	-	-	23,481	3,880	-	1,103,603	-	182,356
7.5	22	1	21	-	-	25,523	4,217	-	-	25,523	4,217	-	561,500	-	92,780
2.5	13	1	12	-	-	27,565	4,555	-	-	27,565	4,555	-	358,339	-	59,211
-2.5	0	0	0	-	-	29,606	4,892	-	-	29,606	4,892	-	-	-	-
-7.5	0	0	0	-	-	31,648	5,229	-	-	31,648	5,229	-	-	-	-
TOTALS	**8,760**	**417**	**8,343**									**-**	**64,319,334**	**-**	**10,627,917**

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 1 Install Roof Insulation

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Fiberglass Blown in Insulation (8-11/16", R-30)	2,425	SF	$ 0.48	$ 0.31	$ 0.15	$ 1,141	$ 910	$ 396	$ 2,447	Costs from Means
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 2,447	Subtotal
$ 367	15% Contingency
$ 422	15% Contractor O&P
$ -	Engineering
$ 3,236	**Total**

APPENDIX C

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Borough of Ocean Gate
CHA #21611
Fire Hall

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.49		
Proposed Fuel Cost	$ 1.49		
Baseline Fuel Use	3,518	Therms	Based on historical utility data
Existing Boiler Plant Efficiency	80%		Estimated or Measured
Baseline Boiler Load	2,814	Mbtu/yr	
Baseline Fuel Cost	$ 5,232		
Proposed Boiler Plant Efficiency	88%		New Boiler Efficiency, based on manufacturers data and operating hours
Proposed Fuel Use	3,197	Therms	
Proposed Fuel Cost	$ 4,755		
Annual Savings	321	Therms	
Annual Savings	**$ 478**	**/yr**	

Fuel Table

	Fuel Type	HHV	Units
1	Nat.Gas	100	Therms
2	Propane	91	Gals LPG
3	#2 Oil	138.7	Gals #2
4	#4 Oil	148.1	Gals # 4
5	#6 Oil	155.9	Gals # 6
6	Electric	3.413	kWh

Existing	Proposed
1	1

Borough of Ocean Gate
CHA #21611
Fire Hall

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Description
Existing heating hot water (HHW) supply setpoint is 180°F.
Proposed:
Vary heating hot water supply temperature as building heating load decreases in relation to outside air temperature.

	$ 1.49								
A	$ 1.49	C	D	E	F	G	H	I	J
					Proposed Usage			Utility Usage	
Amb. Bin Temp °F	Avg. DB Bin Temp °F	Bin Hours	Heating Bin HOURS	Existing Heat Loss In Piping MBH	Avg. HHW Temp @ OA Temp °F	Proposed Heat Loss In Piping MBH	Proposed Boiler Efficiency	Existing Utility Use Therms/Yr	Proposed Utility Use Therms/Yr
100-104	102.5	0	0	0	0	0	0.0%	0	0
95-99	97.5	3	0	0	0	0	0.0%	0	0
90-94	92.5	34	0	0	0	0	0.0%	0	0
85-89	87.5	131	0	0	0	0	0.0%	0	0
80-84	82.5	500	0	0	0	0	0.0%	0	0
75-79	77.5	620	0	0	0	0	0.0%	0	0
70-74	72.5	664	0	0	0	0	0.0%	0	0
65-69	67.5	854	0	0	0	0	0.0%	0	0
60-64	62.5	927	0	0	0	0	92.0%	0	0
55-59	57.5	600	600	275	90	155	91.0%	3	2
50-54	52.5	610	610	279	97	158	90.0%	3	2
45-49	47.5	611	611	280	105	158	89.4%	3	2
40-44	42.5	656	656	300	112	170	88.4%	3	2
35-39	37.5	1,023	1,023	468	119	265	87.5%	5	3
30-34	32.5	734	734	336	126	190	86.6%	4	2
25-29	27.5	334	334	153	134	86	85.8%	2	1
20-24	22.5	252	252	115	141	65	84.9%	1	1
15-19	17.5	125	125	57	148	32	84.0%	1	0
10-14	12.5	47	47	22	155	12	83.1%	0	0
5-9	7.5	22	22	10	163	6	82.2%	0	0
0-4	2.5	13	13	6	170	3	81.4%	0	0
(5) - (1)	-2.5	0	0	0	170	0	80.5%	0	0
(10) - (6)	-7.5	0	0	0	170	0	79.6%	0	0
Totals		**8,760**	**5,027**	**2,300**		**1,301**		**26**	**15**

Annual Energy Savings		**11**	**Therms/yr**
Annual Cost Savings	**$**	**13**	**/yr**

Existing Boiler Efficiency	80%	
Avg. Proposed Boiler Efficiency	88%	

Building HHW Piping System		
Heating On Temperature	60	°F
Total Length of Pipe	150	LF
Existing HHW Setpoint High	180	°F
Existing HHW Setpoint Low	160	°F
Avg HHW Temp	170	°F
Avg Pipe Size	1	Inches
Avg Insul Thickness	1	Inches
Existing Heat Loss	12.2	Btu/Hr/LF
Percent in Uncond. Space	25%	
Existing System Heat Loss	458	Btu/Hr
Proposed Min HHW Return*	80	°F
Avg Prop HHW Supply Temp	115	°F
Proposed Heat Loss	6.9	Btu/Hr/LF
Proposed System Heat Loss	259	Btu/Hr

*Refer to proposed boiler capabilities

Size (in)	Length (ft)
1 1/2	25
1	25
3/4	100
1	**Average**

Total Pipe Length is estimated based on building size, height, and perimeter

Comments:

D Based on building balance points and bin data.
E Existing heat loss in piping system based on current average HHW temperature.
F Estimated Average HHW temperature with HW reset based on OA temperature.
G Proposed heat loss in piping system based on estimated average HW temperature. Return HHW temp min 70 deg F
H Proposed boiler efficiency based return water temperature and boiler efficiency curve.
I-J Utility usage to overcome heat loss in HHW piping system based on boiler efficiency.

Borough of Ocean Gate
CHA #21611
Fire Hall

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Weil Mclain 399 MBH Condensing Gas Boiler (91.7% AFUE)	1	Boiler	$ 6,804	$ 500		$ 6,668	$ 605	$ -	$ 7,273	From Vendor
BMS II Boiler Control System	1	Controller	$ 1,500	$ 300		$ 1,470	$ 363	$ -	$ 1,833	With HW Reset
Old Boiler Removal	1	Boiler		$ 250		$ -	$ 303	$ -	$ 303	
Miscellaneous Electrical	1	LS	$ 200	$ 250		$ 196	$ 303	$ -	$ 499	
Miscellaneous Piping Modifications	1	LS	$ 300	$ 250		$ 294	$ 303	$ -	$ 597	
4" PVC Piping Flue Replacement	20	LF	$ 9.60	$ 15.60		$ 188	$ 378	$ -	$ 566	Cost from Means
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$	11,069	Subtotal
$	1,107	10% Contingency
$	1,218	10% Contractor O&P
$	-	Engineering
$	**13,394**	**Total**

APPENDIX D

ECM-3 Temperature Setback

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 3 Temperature Setback

Building Footprint	3,483	SF	Ex Occupied Clng Temp.	74	°F	Ex Occupied Htg Temp.	70	°F	**Heating Energy Savings**	1,247	therms
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	74	°F	Ex Unoccupied Htg Temp.	70	°F	**Cooling Energy Savings**	0	kWh
Cooling Efficiency	0	kW/ton	Prop Occupied Clng Temp.	74	°F	Prop Occupied Htg Temp.	70	°F			
Building Balance Temp.	65	°F	Prop Unoccupied Clng Temp.	74	°F	Prop Unoccupied Htg Temp.	60	°F			
Internal Gains	12,270	btu/h	Occupied Cooling UA	-3,777	btu/hr/°F	Occupied Heating UA	1,373	btu/hr/°F			
Unoc Internal Gain factor	0.05		Unoccupied Cooling UA	-3,148	btu/hr/°F	Unoccupied Heating UA	1,373	btu/hr/°F			
Ave Occ Internal Gain Factor	0.7		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb						
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb						

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-107,630	-41,145	-8,589	-89,723	-41,145	-613	-107,630	-41,145	-8,589	-89,723	-41,145	-613	0	0	0	0
97.5	42.5	3	0	3	-88,748	-28,573	-8,589	-73,982	-28,573	-613	-88,748	-28,573	-8,589	-73,982	-28,573	-613	0	0	0	0
92.5	39.5	34	2	32	-69,865	-22,858	-8,589	-58,241	-22,858	-613	-69,865	-22,858	-8,589	-58,241	-22,858	-613	0	0	0	0
87.5	36.6	131	6	125	-50,983	-17,334	-8,589	-42,500	-17,334	-613	-50,983	-17,334	-8,589	-42,500	-17,334	-613	0	0	0	0
82.5	34	500	24	476	-32,100	-12,382	-8,589	-26,760	-12,382	-613	-32,100	-12,382	-8,589	-26,760	-12,382	-613	0	0	0	0
77.5	31.6	620	30	590	-13,218	-7,810	-8,589	-11,019	-7,810	-613	-13,218	-7,810	-8,589	-11,019	-7,810	-613	0	0	0	0
72.5	29.2	664	32	632	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0	0	0
67.5	27	854	41	813	3,432	1,143	-8,589	3,432	1,143	-613	3,432	1,143	-8,589	0	0	-613	0	0	0	0
62.5	24.5	927	44	883	10,296	3,429	-8,589	10,296	3,429	-613	10,296	3,429	-8,589	0	0	-613	0	0	148	-4
57.5	21.4	600	29	571	17,159	5,715	-8,589	17,159	5,715	-613	17,159	5,715	-8,589	3,432	1,143	-613	0	0	164	33
52.5	18.7	610	29	581	24,023	8,000	-8,589	24,023	8,000	-613	24,023	8,000	-8,589	10,296	3,429	-613	0	0	237	104
47.5	16.2	611	29	582	30,887	10,286	-8,589	30,887	10,286	-613	30,887	10,286	-8,589	17,159	5,715	-613	0	0	307	174
42.5	14.4	656	31	625	37,750	12,572	-8,589	37,750	12,572	-613	37,750	12,572	-8,589	24,023	8,000	-613	0	0	404	262
37.5	12.6	1,023	49	974	44,614	14,858	-8,589	44,614	14,858	-613	44,614	14,858	-8,589	30,887	10,286	-613	0	0	748	525
32.5	10.7	734	35	699	51,478	17,144	-8,589	51,478	17,144	-613	51,478	17,144	-8,589	37,750	12,572	-613	0	0	620	461
27.5	8.6	334	16	318	58,342	19,430	-8,589	58,342	19,430	-613	58,342	19,430	-8,589	44,614	14,858	-613	0	0	321	248
22.5	6.8	252	12	240	65,205	21,715	-8,589	65,205	21,715	-613	65,205	21,715	-8,589	51,478	17,144	-613	0	0	271	216
17.5	5.5	125	6	119	72,069	24,001	-8,589	72,069	24,001	-613	72,069	24,001	-8,589	58,342	19,430	-613	0	0	149	121
12.5	4.1	47	2	45	78,933	26,287	-8,589	78,933	26,287	-613	78,933	26,287	-8,589	65,205	21,715	-613	0	0	61	51
7.5	2.6	22	1	21	85,796	28,573	-8,589	85,796	28,573	-613	85,796	28,573	-8,589	72,069	24,001	-613	0	0	31	26
2.5	1	13	1	12	92,660	30,859	-8,589	92,660	30,859	-613	92,660	30,859	-8,589	78,933	26,287	-613	0	0	20	17
-2.5	0	0	0	0	99,524	33,145	-8,589	99,524	33,145	-613	99,524	33,145	-8,589	85,796	28,573	-613	0	0	0	0
-7.5	-1.5	0	0	0	106,388	35,431	-8,589	106,388	35,431	-613	106,388	35,431	-8,589	92,660	30,859	-613	0	0	0	0
TOTALS		8,760	417	8,343													0	0	3,480	2,233

Existing Building Ventilation & Infiltration (occ)	**423**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**423**	**cfm**

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 3 Temperature Setback

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Programmable thermostat	1	ea	$ 50	$ 100	$ -	$ 49	$ 121	$ -	$ 170	
Wiring and Controls to link 5 T-stats into 1	1	LS	$ 250	$ 250		$ 245	$ 303	$ -	$ 548	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 718	Subtotal
$ 71.75	10% Contingency
$ 78.93	Contractor 10% O&P
$ -	0% Engineering
$ 868	**Total**

APPENDIX E

ECM-4 Install Garage Door Seals

Borough of Ocean Gate
CHA #21611
Fire Hall

ECM 4 Seal Garage Doors

Description Old windows can lead to increased energy consumption due to infiltration/exfiltration and heat gain/loss. Replacing older windows with more panes and low-emissivity coatings and insulated frames can decrease energy usage.

Given

Occupied Cooling Hours per Week	0	Hours		
Occupied Heating Hours per Week	168	Hours		
Heating Energy Cost	$1.49	$/therm		
Cooling Cost	$0.210	$/kWh		
Occupied Cooling Setpoint Temperature	72.0	Degrees F		(Assumption)
Occupied Cooling Avg Space Air Enthalpy	25.5	btu/# air		(Assumption)
Occupied Heating Setpoint Temperature	70.0	Degrees F	Occupied	(Assumption)
Unoccupied Heating Setpoint Temperature	70.0	Degrees F	Unoccupied	(Assumption)
Door Area	484	sq.ft.		(From door survey)
Door Perimeter	44	ft		(From door survey)
Proposed U factor	0.10	Btu/(h*sqft*degf)		
Proposed Air Infiltration	0.15	cfm/ft		
Cooling Conversion	12,000	Btu/ton		
Heating Btu Conversion	1,000,000	Btu/MMBtu		

Assumptions

Existing U factor	0.10	Btu/(h*sqft*degf)	
Existing Air Infiltration	0.40	cfm/ft	(From ASHRAE Fundamentals)
Heating System Efficiency	80%		
Cooling System Efficiency	-	kW/ton	

Formula

Cooling Energy Conduction = (Existing U x Area x (OA Temp - RA Temp) x Op Hours)

Heating Energy Conduction = (Existing U x Area x (RA Temp - OA Temp) x Op Hours)
Cooling Energy Infiltration = (4.5 x Leakage x Perimeter x (OA Enthalpy - RA Enthalpy) x Op Hours)
Heating Energy Infiltration = 1.08 x Leakage x Perimeter x (RA temp - OA temp) x Op Hours)
Load = (Conduction) + (Infiltration)
Cooling Energy = (Cooling Load) / (12,000 Btu/Ton) x (kw/Ton)
Heating Energy = (Heating Load) / (1,000,000 Btu/MMBtu) / (Boiler Efficiency)
Energy Cost = (Energy) x (Cost/Unit)

Existing

Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	37	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	36.6	87.5	131	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	33.5	82.5	500	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	31.6	77.5	620	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	30.3	72.5	664	0.0	0.0	0.0	0	0	0	0	0	0
Heating	27.9	67.5	854	0.0	854.0	0.0	0	103,334	0	0	40,582	0
Heating	24.6	62.5	927	0.0	927.0	0.0	0	336,501	0	0	132,153	0
Heating	21.6	57.5	600	0.0	600.0	0.0	0	363,000	0	0	142,560	0
Heating	18.7	52.5	610	0.0	610.0	0.0	0	516,670	0	0	202,910	0
Heating	16.2	47.5	611	0.0	611.0	0.0	0	665,379	0	0	261,312	0
Heating	14.3	42.5	656	0.0	656.0	0.0	0	873,136	0	0	342,904	0
Heating	12.4	37.5	1,023	0.0	1023.0	0.0	0	1,609,179	0	0	631,968	0
Heating	10.4	32.5	734	0.0	734.0	0.0	0	1,332,210	0	0	523,195	0
Heating	8.7	27.5	334	0.0	334.0	0.0	0	687,038	0	0	269,819	0
Heating	7	22.5	252	0.0	252.0	0.0	0	579,348	0	0	227,526	0
Heating	5.4	17.5	125	0.0	125.0	0.0	0	317,625	0	0	124,740	0
Heating	3.9	12.5	47	0.0	47.0	0.0	0	130,801	0	0	51,369	0
Heating	2.5	7.5	22	0.0	22.0	0.0	0	66,550	0	0	26,136	0
Heating	1.2	2.5	13	0.0	13.0	0.0	0	42,471	0	0	16,680	0
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			**8,760**	**0**	**6,808**	**0**	**0**	**7,623,242**	**0 btu**	**0**	**2,993,855**	**0 btu**

	Conduction		Infiltration		
Cooling Load =	0	+	0	=	**0 btu**
	Cooling Load				
Cooling Energy =	0	/	12000	* 0.00 =	**0 kWh**
	Cooling Energy		Cooling Cost		
Cooling Energy Cost =	0.00	x	$0.210	=	**$ -**
	Conduction		Infiltration		
Heating Load =	7623242	+	2993855	=	**10,617,097 btu**
	Heating Load		Heat Content		
Heating Energy =	10617097	/	80%	/ 100000 =	**133 therms**
	Heating Energy		Heating Cost		
Heating Energy Cost =	132.71	x	$1.487	=	**$ 197**

Operation	OA Enthalphy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	37	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	36.6	87.5	131	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	33.5	82.5	500	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	31.6	77.5	620	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	30.3	72.5	664	0.0	0.0	0.0	0	0	0	0	0	0
Heating	27.9	67.5	854	0.0	854.0	0.0	0	103,334	0	0	15,218	0
Heating	24.6	62.5	927	0.0	927.0	0.0	0	336,501	0	0	49,557	0
Heating	21.6	57.5	600	0.0	600.0	0.0	0	363,000	0	0	53,460	0
Heating	18.7	52.5	610	0.0	610.0	0.0	0	516,670	0	0	76,091	0
Heating	16.2	47.5	611	0.0	611.0	0.0	0	665,379	0	0	97,992	0
Heating	14.3	42.5	656	0.0	656.0	0.0	0	873,136	0	0	128,589	0
Heating	12.4	37.5	1,023	0.0	1023.0	0.0	0	1,609,179	0	0	236,988	0
Heating	10.4	32.5	734	0.0	734.0	0.0	0	1,332,210	0	0	196,198	0
Heating	8.7	27.5	334	0.0	334.0	0.0	0	687,038	0	0	101,182	0
Heating	7	22.5	252	0.0	252.0	0.0	0	579,348	0	0	85,322	0
Heating	5.4	17.5	125	0.0	125.0	0.0	0	317,625	0	0	46,778	0
Heating	3.9	12.5	47	0.0	47.0	0.0	0	130,801	0	0	19,263	0
Heating	2.5	7.5	22	0.0	22.0	0.0	0	66,550	0	0	9,801	0
Heating	1.2	2.5	13	0.0	13.0	0.0	0	42,471	0	0	6,255	0
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			**8,760**	**0**	**6,808**	**0**	**0**	**7,623,242**	**0 btu**	**0**	**1,122,696**	**0 btu**

	Conduction	Infiltration	
Cooling Load =	(0) + (	0) =	**0 btu**
	Cooling Load		
Cooling Energy =	(0)/(	12000) * (0.00) =	**0 kWh**
	Cooling Energy	Cooling Cost	
Cooling Energy Cost =	(0.00) x (	$0.210) =	**$ -**
	Conduction	Infiltration	
Heating Load =	(7623242) + (	1122696) =	**8,745,938 btu**
	Heating Load	Heat Content	
Heating Energy =	(8745938)/(	80%) / (100000) =	**109 therms**
	Heating Energy	Heating Cost	
Heating Energy Cost =	(109.32) x (	$1.487) =	**$ 163**

Summary

EXISTING COOLING ENERGY	**0.00**	**kWh**	**$**	**-**
EXISTING HEATING ENERGY	**132.71**	**therms**	**$**	**197.41**
EXISTING ENERGY COST			**$**	**197.41**

PROPOSED COOLING ENERGY	**0.00**	**kWh**	**$**	**-**
PROPOSED HEATING ENERGY	**109.32**	**therms**	**$**	**162.62**
PROPOSED ENERGY COST			**$**	**162.62**

COOLING ENERGY SAVINGS	**0.00**	**kWh**	**$**	**-**	**#DIV/0! of existing**
HEATING ENERGY SAVINGS	**23.39**	**therms**	**$**	**34.79**	**17.6% of existing**
ENERGY COST SAVINGS			**$**	**34.79**	**17.6% of existing**

Comments

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 4 Seal Garage Doors

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Garage Door Seals	4	EA	$ 39	$ 25		$ 153	$ 121	$ -	$ 274	From Autosport Catalog Online
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 274	Subtotal
$ 27.39	10% Contingency
$ 30.13	10% Contractor O&P
$ -	0% Engineering
$ 331	**Total**

APPENDIX F

ECM-5 Replace T12 Lights

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 5 Replacement T-12 lights

Building Schedule:
Existing conditions (master switch): 8 hrs/week
Blended Electric Rate $ 0.229 /kWh

Instructions and notes:
Input existing fixtures and retrofit fixtures. Use light table

	EXISTING CONDITIONS										RETROFIT CONDITIONS								COST ANALYSIS				
Area Description	Number of Fixtures	Fixture Code	Watts per Fixture	Number of Non-Operational Fixtures	Watts per Non-Operational Fixtures	kW/Space	Exist Control	Daily Hours	Annual Hours	Annual kWh	Number of Fixtures	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Daily Hours	Annual Hours	Annual kWh	kW Saved	Annual kWh Saved	Annual $ Saved	Retrofit Cost	Simple Payback
Garage Area	10	F42ES	80	0	81.6	0.8	switch		416	333	10	F42ILL	59	0.59	switch		416	245	0.21	87	$ 20	$ 915	45.8
Upstairs Lounge	12	F42ES	80	0	81.6	0.96	switch		416	399	12	F42ILL	59	0.708	switch		416	295	0.25	105	$ 24	$ 1,098	45.8
Mens Bathroom	1	F41ES	43	0	43.86	0.043	switch		416	18	1	F41ILL	31	0.031	switch		416	13	0.01	5	$ 1	$ 91	80.2
Womens Bathroom	1	F41ES	43	0	43.86	0.043	switch		416	18	1	F41ILL	31	0.031	switch		416	13	0.01	5	$ 1	$ 91	80.2
Mens Bathroom	1	I40/1	40	0	40.8	0.04	switch		416	17	1	CF11/1	11	0.011	switch		416	5	0.03	12	$ 3	$ 10	3.6
Womens Bathroom	1	I40/1	40	0	40.8	0.04	switch		416	17	1	CF11/1	11	0.011	switch		416	5	0.03	12	$ 3	$ 10	3.6
																				-	$ -		
TOTALS -	26			0		1.9				801	26			1.4				575	0.5	226	$ 52	$ 2,215	42.8

APPENDIX G

ECM-6 Install IR Heaters in Garage Bay

Borough of Ocean Gate
CHA #21611
Fire Hall

ECM 6: Install IR Heaters in Garage Bays

Building Footprint	3,453	SF	Ex Occupied Htg Temp.	70	°F	Heating Energy Savings	544 Therms/year
Natural gas Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	70	°F	Electric Energy Savings	367 kWh/yr
Building Balance Temp.	60	°F	Occupied Heating UA	824	btu/hr/°F		
Internal Gains	12,270	btu/h	Unoccupied Heating UA	824	btu/hr/°F		
Unocc Internal Gain factor	0.05						
Ave Occ Internal Gain Factor	0.7						

Existing Burner Efficiency	80.0%	
Existing Heat Distribution Effectiveness	95.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters
Proposed Burner Efficiency	86.0%	Based on Reznor Infrared Tube Heaters
Proposed Heat Distribution Effectiveness	100%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Infrared Heaters

					EXISTING LOADS						PROPOSED LOADS							
					Occupied			Unoccupied			Occupied			Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Heating Therms	Proposed Heating Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	0	0	0	0	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
97.5	49.1	3	0	3	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
92.5	42.5	34	2	32	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
87.5	39.5	131	6	125	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
82.5	36.6	500	24	476	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
77.5	34	620	30	590	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
72.5	31.6	664	32	632	0	0	-8,589	0	0	-613	0	0	-8,589	0	0	-613	0	0
67.5	29.2	854	41	813	2,059	1,143	-8,589	2,059	1,143	-613	2,059	1,143	-8,589	2,059	1,143	-613	0	0
62.5	27	927	44	883	6,177	3,429	-8,589	6,177	3,429	-613	6,177	3,429	-8,589	6,177	3,429	-613	0	0
57.5	24.5	600	29	571	10,296	5,715	-8,589	10,296	5,715	-613	10,296	5,715	-8,589	10,296	5,715	-613	133	106
52.5	21.4	610	29	581	14,414	8,000	-8,589	14,414	8,000	-613	14,414	8,000	-8,589	14,414	8,000	-613	192	154
47.5	18.7	611	29	582	18,532	10,286	-8,589	18,532	10,286	-613	18,532	10,286	-8,589	18,532	10,286	-613	250	200
42.5	16.2	656	31	625	22,650	12,572	-8,589	22,650	12,572	-613	22,650	12,572	-8,589	22,650	12,572	-613	330	264
37.5	14.4	1,023	49	974	26,768	14,858	-8,589	26,768	14,858	-613	26,768	14,858	-8,589	26,768	14,858	-613	611	489
32.5	12.6	734	35	699	30,887	17,144	-8,589	30,887	17,144	-613	30,887	17,144	-8,589	30,887	17,144	-613	508	406
27.5	10.7	334	16	318	35,005	19,430	-8,589	35,005	19,430	-613	35,005	19,430	-8,589	35,005	19,430	-613	262	210
22.5	8.6	252	12	240	39,123	21,715	-8,589	39,123	21,715	-613	39,123	21,715	-8,589	39,123	21,715	-613	222	177
17.5	6.8	125	6	119	43,241	24,001	-8,589	43,241	24,001	-613	43,241	24,001	-8,589	43,241	24,001	-613	122	97
12.5	5.5	47	2	45	47,360	26,287	-8,589	47,360	26,287	-613	47,360	26,287	-8,589	47,360	26,287	-613	50	40
7.5	4.1	22	1	21	51,478	28,573	-8,589	51,478	28,573	-613	51,478	28,573	-8,589	51,478	28,573	-613	26	20
2.5	2.6	13	1	12	55,596	30,859	-8,589	55,596	30,859	-613	55,596	30,859	-8,589	55,596	30,859	-613	16	13
-2.5	-1.5	0	0	0	59,714	33,145	-8,589	59,714	33,145	-613	59,714	33,145	-8,589	59,714	33,145	-613	0	0
-7.5	0	0	0	0	63,833	35,431	-8,589	63,833	35,431	-613	63,833	35,431	-8,589	63,833	35,431	-613	0	0
TOTALS		8,760	417	8,343													2,722	2,178

Existing Building Ventilation & Infiltration (occ)	423	cfm
Overheat Ventilation Factor	1.00	
Additional ventilation to offset overheat	0	cfm
Existing Building Ventilation & Infiltration (unocc)	423	cfm

Electrical Requirements for Heating Equipment

Existing Equipment

Unit	Htng Hrs	Motor HP	Motor kW	Annual kWh
HWH-1	2,090	0.125	0.09325	195
HWH-2	2,090	0.125	0.09325	195
HWH-3	2,090	0.125	0.09325	195
HWH-4	2,090	0.125	0.09325	195
Total				780

Proposed Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
Infrared Htr	2,090	1.1	115	1	0.8	212
Infrared Htr	2,090	1.1	115	1	0.8	212
Total						423

*Electrical data based on Reznor VR Series Infrared Heaters

Avg. OA Temp °F	Heating Hrs	Assumed % Time of Operation	hrs of Operation
102.5	0	0%	0
97.5	0	0%	0
92.5	0	0%	0
87.5	0	0%	0
82.5	0	0%	0
77.5	0	0%	0
72.5	0	0%	0
67.5	0	0%	0
62.5	0	8%	0
57.5	600	15%	92
52.5	610	23%	141
47.5	611	31%	188
42.5	656	38%	252
37.5	1023	46%	472
32.5	734	54%	395
27.5	334	62%	209
22.5	252	69%	174
17.5	125	77%	96
12.5	47	85%	40
7.5	22	92%	20
2.5	13	100%	13
-2.5	0	100%	0
-7.5	0	100%	0
	5,027	42%	2090

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

ECM 6: Install IR Heaters in Garage Bays

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Hot Water Heater Removal	4	EA		$ 300		$ -	$ 1,452	$ -	$ 1,452	
20' Low intensity Infrared Tube Heater 45 MBH	2	EA	$ 1,039	$ 400		$ 2,036	$ 968	$ -	$ 3,004	From HMAC online
Miscellaneous Gas Piping, Valves, etc.	2	EA	$ 400	$ 250		$ 784	$ 605	$ -	$ 1,389	
4" Class B Vent Piping	30	LF	$ 6.70	$ 10		$ 197	$ 363	$ -	$ 560	
Miscellaneous electrical	1	LS	$ 250	$ 250		$ 245	$ 303	$ -	$ 548	
Hot Water Piping Capping	4	Heaters	$ 5	$ 50		$ 20	$ 242	$ -	$ 262	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 7,215	Subtotal
$ 721.45	10% Contingency
$ 793.60	Contractor 10% O&P
$ -	0% Engineering
$ 8,730	**Total**

APPENDIX H

New Jersey Pay For Performance Incentive Program

Borough of Ocean Gate
CHA #21611
Fire Hall

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2010. Building must have a minimum average electric demand of 200 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
The incentive values represented below are applicable through December 31, 2010.

Total Building Area (Square Feet)	3,483
Is this audit funded by the NJ BPU (Y/N)	Yes

Bureau of Public Utilites (BPU)

Incentive #1		
Audit not funded by NJ BPU	$0.10	$/sqft
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$2,936	$5,232
Existing Usage (from utility)	12,844	3,518
Proposed Savings	549	2,272
Existing Total MMBtus	396	
Proposed Savings MMBtus	229	
% Energy Reduction	**57.9%**	
Proposed Annual Savings	$2,878	

	≥ %15	
	$/kWh	$/therm
Incentive #2	$0.11	$1.10
Incentive #3	$0.07	$0.70

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$174
Incentive #2	$60	$2,499	$2,559
Incentive #3	$38	$1,590	$1,629
Total All Incentives	**$99**	**$4,089**	**$4,362**

Total Project Cost	$28,276

		Allowable Incentive
% Incentives #1 of Utility Cost*	2.1%	$174
% Incentives #2 of Project Cost**	9.1%	$2,559
% Incentives #3 of Project Cost**	5.8%	$1,629
Total Eligible Incentives***	**$4,362**	
Project Cost w/ Incentives	$23,914	

Project Payback (years)	
w/o Incentives	w/ Incentives
9.8	8.3

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 30% of total project cost.
Maximum allowable amount of Incentive #3 is 20% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account

APPENDIX I

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts * * * AC Energy & Cost Savings

Cautions for Interpreting the Results

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	16.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	12.3 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	22.9 ¢/kWh

Results

Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	1325	303.43
2	4.05	1430	327.47
3	4.58	1735	397.31
4	4.84	1696	388.38
5	5.30	1868	427.77
6	5.33	1762	403.50
7	5.27	1779	407.39
8	5.25	1761	403.27
9	5.06	1708	391.13
10	4.46	1609	368.46
11	3.15	1148	262.89
12	2.87	1107	253.50
Year	4.46	18928	4334.51

Output Hourly Performance Data

About the Hourly Performance Data

Output Results as Text

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

Cautions for Interpreting the Results

The monthly and yearly energy production are modeled using the PV system parameters you selected and weather data that are typical or representative of long-term averages. For reference, or comparison with local information, the solar radiation values modeled for the PV array are included in the performance results.

Because weather patterns vary from year-to-year, the values in the tables are better indicators of long-term performance than performance for a particular month or year. PV performance is largely proportional to the amount of solar radiation received, which may vary from the long-term average by ± 30% for monthly values and ± 10% for yearly values. How the solar radiation might vary for your location may be evaluated by examining the tables in the *Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors* (*http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/*).

For these variations and the uncertainties associated with the weather data and the model used to model the PV performance, future months and years may be encountered where the actual PV performance is less than or greater than the values shown in the table. The variations may be as much as 40% for individual months and up to 20% for individual years. Compared to long-term performance over many years, the values in the table are accurate to within 10% to 12%.

If the default overall DC to AC derate factor is used, the energy values in the table will overestimate the actual energy production if nearby buildings, objects, or other PV modules and array structure shade the PV modules; if tracking mechanisms for one- and two-axis tracking systems do not keep the PV arrays at the optimum orientation with respect to the sun's position; if soiling or snow cover related losses exceed 5%; or if the system performance has degraded from new. (PV performance typically degrades 1% per year.) If any of these situations exist, an overall DC to AC derate factor should be used with PVWATTS that was calculated using system specific component derate factors for *shading*, *sun-tracking*, *soiling*, and *age*.

The PV system size is the nameplate DC power rating. The energy production values in the table are valid only for crystalline silicon PV systems.

The cost savings are determined as the product of the number of kilowatt hours (kWh) and the cost of electricity per kWh. These cost savings occur if the owner uses all the electricity produced by the PV system, or if the owner has a net-metering agreement with the utility. With net-metering, the utility bills the owner for the net electricity consumed. When electricity flows from the utility to the owner, the meter spins forward. When electricity flows from the PV system to the utility, the meter spins backwards.

If net-metering isn't available and the PV system sends surplus electricity to the utility grid, the utility generally buys the electricity from the owner at a lower price than the owner pays the utility for electricity. In this case, the cost savings shown in the table should be reduced.

Besides the cost savings shown in the table, other benefits of PV systems include greater energy independence and a reduction in fossil fuel usage and air pollution. For commercial customers, additional cost savings may come from reducing demand charges. Homeowners can often include the cost of the PV system in their home mortgage as a way of accommodating the PV system's initial cost.

To accelerate the use of PV systems, many state and local governments offer financial incentives and programs. Go to http://www.nrel.gov/stateandlocal for more information.

Ocean Gate Borough
Volunteer Fire Hall

Cost of Electricity $0.229 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-16 kW System

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	New Jersey Renewable * Energy Incentive	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$128,000	**0.0**	**18,900**	**0**	**$4,300**	**0**	**$4,300**	**$12,000**	**$9,200**	**29.8**	**8.6**

Note: Budgetary cost is based on $8,000/kW.

*Incentive based on New Jersey renewable energy program for non-residential applications(PV)= $0.75/W of installed PV system

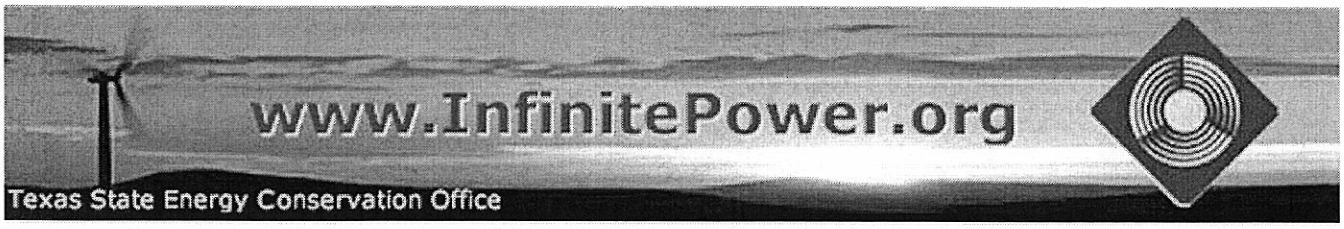
** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

Estimated Solar Renewable Energy Certificate Program (SREC) payments for 15 Years from RR Renewable Energy Consultants

Year	SREC
1	600
2	600
3	600
4	500
5	500
6	500
7	500
8	500
9	500
10	500
11	400
12	400
13	400
14	400
15	400
AVG	**487**

APPENDIX J

Solar Thermal Domestic Hot Water Plant



Home

What Can I Do?

Electric Choice

Home Energy

FAQs

LEARN
Fact Sheets
Lesson Plans

PLAY
Calculators

NETWORK
Organizations
Businesses
Events Calendar

BROWSE
Resources
Solar
Wind
Biomass
Geothermal
Water

Projects

TX Energy - Past and Present

Financial Help

About Us

About SECO

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Interactive Energy Calculators

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

Our calculators help you understand energy production and consumption in a whole new way. Use them to develop a personal profile of your own energy use.

Carbon Pollution Calculator
Electric Power Pollution Calculator
PV System Economics
Solar Water Heating
What's a Watt?

Solar Water Heating Calculator

Water heating is a major energy consumer. Although the energy consumed daily is often less than for air conditioning or heating, it is required year round, making it a good application of solar energy. Use this calculator to explore the energy usage of your water heater, and to estimate whether a solar water heater could save you money.

Water Heater Characteristics			
Physical		**Thermal**	
? Diameter (feet)	1.5	? Water Inlet Temperature (Degrees F)	58
? Capacity (gallons)	40	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	17.79	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	10
Energy Use			
212.1		? Heat Delivered in Hot Water (BTU/hr)	
0		? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		**Electric**
0.8	? Overall Efficiency	0.98
0.8	? Conversion Efficiency	0.98
265.1 BTU/hr	? Power Into Water Heater	216.4 BTU/hr
Cost		
$ 1.49 /Therm	? Utility Rates	$ 0.08 /kWh
$ 34.6019	? Yearly Water Heating Cost	$ 44.4154(
How Does Solar Compare?		

? Solar Water Heater Cost: $ 27100		? Percentage Solar: 70
1118.84 years for gas	? Payback Time for Solar System	871.640 years for electric

More information on solar water heating:

Fact sheet - Solar Water Heaters
Fact sheet - Solar Water Heaters for Swimming Pools
Kids fact sheet - Heat from the Sun

Return to Top of Page

Send comments, questions, and suggestions to **website manager**.

Window on State Government | **Privacy and Security Policy** | **Accessibility Policy**

State Energy Conservation Office (SECO)

NJBPU Energy Audits
CHA #21611
Building: Borough of Ocean Gate Fire Hall

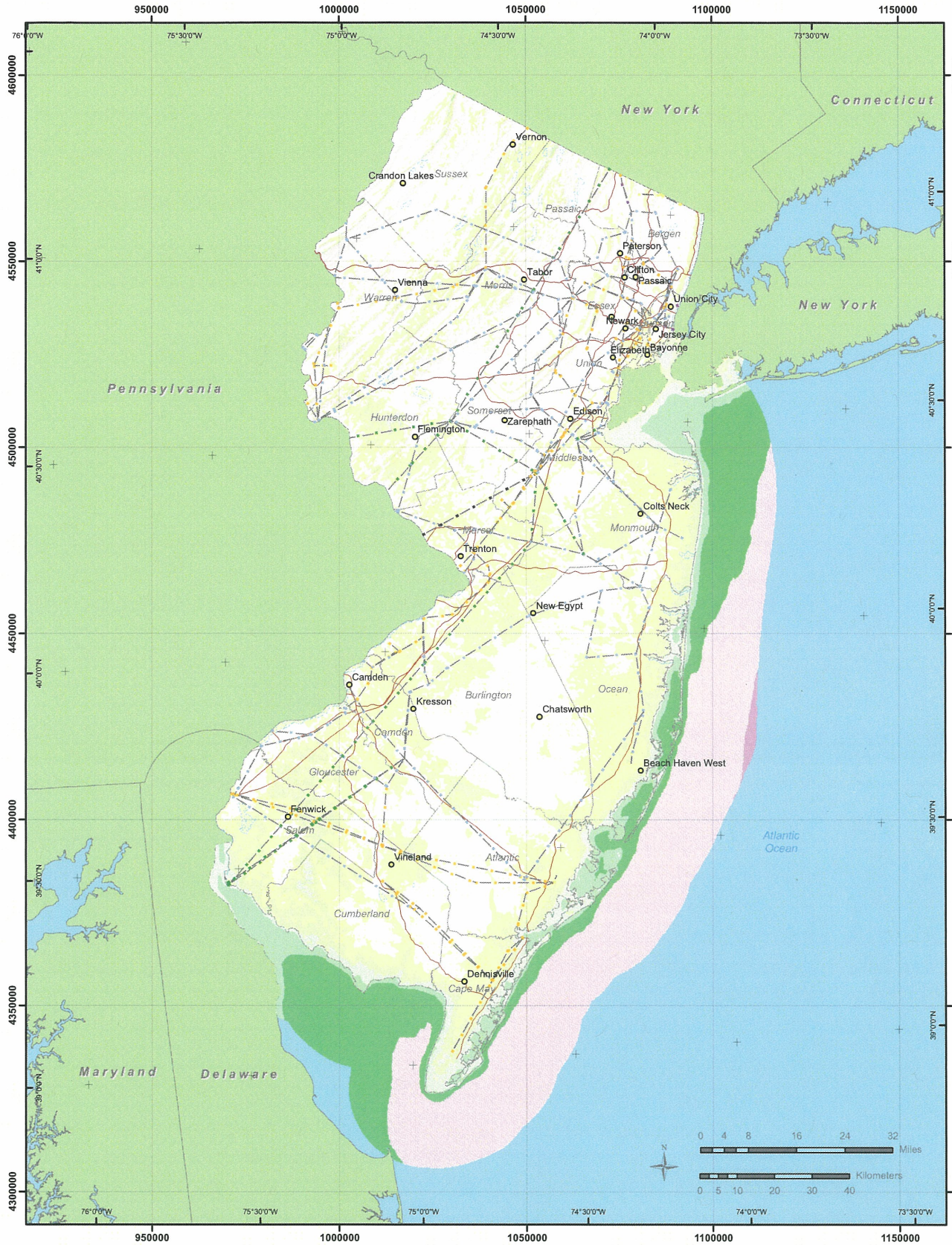
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Synergy Solar Thermal System	2	ea			$ 3,600	$ -	$ -	$ 7,848	$ 7,848	
Piping modifications	1	ls	$ 2,000	$ 3,500		$ 1,960	$ 4,235	$ -	$ 6,195	
Electrical modifications	1	ls	$ 1,000	$ 1,000		$ 980	$ 1,210	$ -	$ 2,190	
65 Gallon Storage Tanks	2	ea	$ 200	$ 250		$ 400	$ 500	$ -	$ 900	
10 Gallon Drip Tank	2	ea	$ 100	$ 78		$ 200	$ 156	$ -	$ 356	
						$ -	$ -	$ -	$ -	

$17,489	Subtotal
$ 2,623	15% Contingency
$ 2,623	15% Contractor O&P
$ 4,372	25% Engineering
$27,108	**Total**

APPENDIX K

Wind



Wind Resource of New Jersey

Mean Annual Wind Speed at 30 Meters

Features

- City
- Interstate Highway
- County Boundary
- Water Body

Generalized Transmission Line

Category	
Under 100 kV	500 kV
100 kV-161 kV	735 kV +
230 kV-287 kV	Step-Up
345 kV	DC Line

Mean Speed at 30 m		
mph	m/s	
< 10.1	< 4.5	13.4 - 14.5 / 6.0 - 6.5
10.1 - 11.2	4.5 - 5.0	14.5 - 15.7 / 6.5 - 7.0
11.2 - 12.3	5.0 - 5.5	15.7 - 16.8 / 7.0 - 7.5
12.3 - 13.4	5.5 - 6.0	16.8 - 17.9 / 7.5 - 8.0
		17.9 - 19.0 / 8.0 - 8.5
		> 19.0 / > 8.5

AWS Truewind

Projection: Tranverse Mercator,
UTM Zone 17 WGS84
Spatial Resolution of Wind Resource Data: 200m
This map was created by AWS Truewind using the MesoMap system and historical weather data. Although it is believed to represent an accurate overall picture of the wind energy resource, estimates at any location should be confirmed by measurement.

The transmission line information was obtained by AWS Truewind from the Global Energy Decisions Velocity Suite. AWS does not warrant the accuracy of the transmission line information.


E Cape May Ave
E Cape May Ave
E Arverne Ave
E Arverne Ave
Asbury Ave
bing
© GlobeXplorer © 2010 Navteq © 2010 Microsoft

APPENDIX L

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Ocean Gate Fire Hall

Building ID: 2366561
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: July 12, 2010

Facility	Facility Owner	Primary Contact for this Facility
Ocean Gate Fire Hall 151 E Longport Avenue Ocean Gate, NJ 08740	Borough of OceanGate 801 Ocean Gate Ave Ocean Gate, NJ 08740	Paulette Konopka 801 Ocean Gate Ave Ocean Gate, NJ 08740

Year Built: 1949
Gross Floor Area (ft²): 3,483

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	43,824
Natural Gas (kBtu)[4]	351,600
Total Energy (kBtu)	395,424

Energy Intensity[5]	
Site (kBtu/ft²/yr)	114
Source (kBtu/ft²/yr)	148

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	25

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-6%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] for Indoor Environmental Conditions:	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE or RA in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Building Name	Ocean Gate Fire Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Fire Station/Police Station	Is this an accurate description of the space in question?		☐
Location	151 E Longport Avenue, Ocean Gate, NJ 08740	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Ocean Gate Fire Hall (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Gross Floor Area	3,483 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	N/A(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: FirstEnergy - Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Fire Hall Electric (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2009	12/31/2009	1,094.00
11/01/2009	11/30/2009	813.00
10/01/2009	10/31/2009	718.00
09/01/2009	09/30/2009	1,063.00
08/01/2009	08/31/2009	1,570.00
07/01/2009	07/31/2009	1,456.00
06/01/2009	06/30/2009	898.00
05/01/2009	05/31/2009	909.00
04/01/2009	04/30/2009	958.00
03/01/2009	03/31/2009	1,011.00
02/01/2009	02/28/2009	1,102.00
01/01/2009	01/31/2009	1,252.00
Fire Hall Electric Consumption (kWh (thousand Watt-hours))		**12,844.00**
Fire Hall Electric Consumption (kBtu (thousand Btu))		**43,823.73**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**43,823.73**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: Fire Hall Gas (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
12/01/2009	12/31/2009	499.00
11/01/2009	11/30/2009	289.00
10/01/2009	10/31/2009	62.00
09/01/2009	09/30/2009	10.00
08/01/2009	08/31/2009	100.00
07/01/2009	07/31/2009	31.00
06/01/2009	06/30/2009	77.00
05/01/2009	05/31/2009	108.00
04/01/2009	04/30/2009	525.00
03/01/2009	03/31/2009	392.00

02/01/2009	02/28/2009	859.00
01/01/2009	01/31/2009	564.00
Fire Hall Gas Consumption (therms)		**3,516.00**
Fire Hall Gas Consumption (kBtu (thousand Btu))		**351,600.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**351,600.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same PE or RA that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Ocean Gate Fire Hall
151 E Longport Avenue
Ocean Gate, NJ 08740

Facility Owner
Borough of OceanGate
801 Ocean Gate Ave
Ocean Gate, NJ 08740

Primary Contact for this Facility
Paulette Konopka
801 Ocean Gate Ave
Ocean Gate, NJ 08740

General Information

Ocean Gate Fire Hall	
Gross Floor Area Excluding Parking: (ft²)	3,483
Year Built	1949
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

Ocean Gate Fire Hall	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft²)	3,483
Number of PCs[o]	N/A
Weekly operating hours[o]	N/A
Workers on Main Shift[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2009)	**Baseline** (Ending Date 12/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	114	114	0	N/A	78
Source (kBtu/ft²)	148	148	0	N/A	157
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/ft²/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	25	25	0	N/A	17
$kgCO_2e/ft^2$/year	7	7	0	N/A	5

More than 50% of your building is defined as Fire Station/Police Station. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Fire Station/Police Station. This building uses X% less energy per square foot than the CBECS national average for Fire Station/Police Station.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

APPENDIX M

Equipment Inventory & Lighting

New Jersey BPU Energy Audit Program
CHA #21611
Borough of Ocean Gate
Volunteer Fire House

Description	Qty	Manufacturer Name	Model No.	Serial Number	Equipment Type	Capacity/Size	Operation Hours	Location	Areas Served	Estimated Efficiency	Approximate Age	Useable Life Expectancy (years)
DHW Heater	1	A. O. Smith	F5G40212	NA	Gas	40 Gallon, 32000 Btu/hr	As Needed	Outside Mech. Room	Upstairs	80%	10	19
Boiler	1	Weil McLain	EGH-95-PL	NA	Gas	400000 Btu	Year round	Outside Mech. Room	Entire Building	80%	18	24
Unit Heaters	4	Webster-Nesbitt	127W	NA	Gas	Hot Water From Boiler	Year round	Garage Area	Garage Bay	80%	15	15

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

Existing Lighting

Building Schedule:
Existing conditions (master switch): 8 hrs/week
Blended Electric Rate $ 0.229 /kWh

Instructions and notes:
Input existing fixtures and retrofit fixtures. Use light table

	EXISTING CONDITIONS									
Area Description	**Number of Fixtures**	**Fixture Code**	**Watts per Fixture**	**Number of Non-Operational Fixtures**	**Watts per Non-Operational Fixtures**	**kW/Space**	**Exist Control**	**Daily Hours**	**Annual Hours**	**Annual kWh**
Garage Area	10	F42ES	80	0	81.6	0.8	switch		416	333
Upstairs Lounge	12	F42ES	80	0	81.6	0.96	switch		416	399
Mens Bathroom	1	F41ES	43	0	43.86	0.043	switch		416	18
Womens Bathroom	1	F41ES	43	0	43.86	0.043	switch		416	18
Mens Bathroom	1	I40/1	40	0	40.8	0.04	switch		416	17
Womens Bathroom	1	I40/1	40	0	40.8	0.04	switch		416	17
TOTALS -	**26**			**0**		**1.9**				**801**

APPENDIX N

Block Load Models

HEAT GAIN/LOSS WORKSHEET

Project Name:	Borough of Ocean Gate	**Project No.:**	CHA #21611		
Location	Ocean Gate, NJ	**Site Elevation:**	460 Feet	**Specific Volume**	14.00 CF/#
Building Name	Fire Hall	**Date:**	06/18/10		
Engineer:	Matt Pittinger				

Building/Facility Designation Fire Hall

Outdoor Winter Design DB Temperature	2.5 *F	**Indoor Winter Design DB Temperature**	68 *F
Outdoor Summer Design DB Temperature	90 *F	**Indoor Summer Design DB Temperature**	74 *F
Outdoor Summer Design WB Temperature	73 *F	**Indoor Summer Design WB Temperature**	60 *F
Outdoor Summer Humidity Ratio	0.0121 #/#	**Indoor Air (70*F) Humidity Ratio**	0.0079 #/#

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

		R Value	Wall Type
	Steel Siding, 4" Insulation, Steel Siding	15.2	1
	Plaster or Gypsum, frame construction, 5" Insulation, 1" stucco	18.2	1
	4" WH CMU, 1" Insulation, Finished Exterior	5.2	2
	Plaster or Gypsum, frame construction, 3" Insulation, 8" LW CMU	7.8	5
	4" Face Brick, 2" Concrete, 1" Insulation, Exterior Finish	5.1	12
	4" Face Brick, 4" Concrete, 1" Insulation, Exterior Finish	4.0	11
	Interior Finish, 2" Insulation, 8" CMU, 4" Face Brick	10.9	16
	Finished Surface, 8" LW CMU (filled), Air Space, 4" Face Brick	11.1	16
	Stucco or Gypsum, 2.5" Insul, Face Brick	14.3	10
	4" Block, 1" insulation, 8" Block	19.9	16
x	Outside Air Resistance, Concrete Block, Airspace, insulation, Paint, Inside Air Resist	4.2	

Roofs (Select One)

		R Value	Roof Type
	Tectum Deck, 3.3" Insul., BU Roof	13.0	1
	Steel Deck, 5" Insul., BU Roof	18.2	1
	Attic Roof with 6" Insul.	25.0	4
	4" HW Concrete Deck, BU Roof	2.7	2
	Ceiling, 3" Insulation, 4" Concrete Deck, BU Roof	14.9	4
	Ceiling, 4" Concrete Deck, 3" Insulation, BU Roof	18.5	13
	Ceiling, 4" Concrete Deck, 6" Insulation, BU Roof	21.7	14
	Ceiling, Wood Deck, 6" Insulation, Felt & Membrane	22.7	10
	Wood Deck, 6" insulation, Felt & Membrane	18.0	
x	Outside Surface Resistance, Air Space,Insulation, Insude Surface resistance	5.94	

Windows (Select One)

		U Value
x	Aluminum Frame, 1/8" SP Glazing	1.05
	Aluminum Frame, 1/4" DP Glazing	0.60
	Aluminum Frame, 3/16" DP Glazing	0.62
	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
	Other	

	No Storm
Flat Glass	1.05
Flat Glass (e=.6)	1.00
Flat Glass (e=0.4)	0.90
Flat Glass (e=0.2)	0.77
Double Glaze (3/16 in air)	0.63
Double Glaze (1/4 in air)	0.60
Double Glaze (1/2 in air)	0.53
Double Glaze (e=.6)	0.50
Double Glaze (e=0.4)	0.42
Double Glaze (e=0.2)	0.35
Triple Glaze (1/4 in air)	0.42
Triple Glaze (1/2 in air)	0.35

BUILDING CHARACTERISTICS

Roof Area	2,425 SF		
Occupied Area	3,483 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	59 Ft	12.0 Ft	12.0 Ft	41 SF	21 SF	646 SF
East Exposure	87 Ft	9.7 Ft	12.0 Ft	44 SF	242 SF	554 SF
South Exposure	59 Ft	12.0 Ft	12.0 Ft	90 SF	21 SF	597 SF
West Exposure	87 Ft	9.7 Ft	12.0 Ft	44 SF	242 SF	554 SF

Forced Ventilation 0 cfm

HEAT GAIN/LOSS WORKSHEET

Project Name:	Borough of Ocean Gate	**Project No.:**	CHA #21611		
Location	Ocean Gate, NJ	**Site Elevation:**	460 Feet	**Specific Volume**	14.00 CF/#
Building Name	Fire Hall	**Date:**	06/18/10		
Engineer:	Matt Pittinger				

Building/Facility Designation Fire Hall

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	41	38 btu/h/sf	0.8	0.75	Glass Type C	939 Btu/hr
East Exposure	44	216 btu/h/sf	0.8	0.31	Glass Type C	2,357 Btu/hr
South Exposure	90	109 btu/h/sf	0.8	0.58	Glass Type C	4,552 Btu/hr
West Exposure	44	216 btu/h/sf	0.8	0.29	Glass Type C	2,205 Btu/hr
						10,053 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	646	0.24	20 *F	1.0	3,062 Btu/hr
East Exposure	758	0.24	39 *F	1.0	7,008 Btu/hr
South Exposure	597	0.24	27 *F	1.0	3,821 Btu/hr
West Exposure	758	0.24	22 *F	1.0	3,953 Btu/hr
Roof	2,425	0.17	73 *F	1.0	29,811 Btu/hr
Fenestration	219	1.05	16 *F		3,683 Btu/hr
Doors	526	0.14	27 *F		1,984 Btu/hr
Ceiling	3,483	0.14	0 *F		0 Btu/hr
Partition		0.05	0 *F		0 Btu/hr
Floor	3,483	0.04	0 *F		0 Btu/hr
					53,321 Btu/h

INTERNAL HEAT GAINS

								Room Heat Gain
Lights	0.70 w/sf x	3,483 Occ Area =	2.4 kW x 3.4x		1.0 RAF =	8,321 Btu/h
Plug Load	0.30 w/sf x	3,483 Occ Area =	1.0 kW x 3.4x		1.0 RAF =	3,566 Btu/h
People	10 people x	255 btu/person x	15% time in space =			383 Btu/h
Computer Work Stations		0 Units x	120 W/Unit x	3414 =		0 Btu/h
Equipment		kW x 3.413 =				0 Btu/h
Misc.						0 Btu/h
						12,270 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain
Walls	2,759 SF	0.14 CFM/SF		1.04	16 *F	6,966 Btu/h
Doors	526 SF	0.20 CFM/LF	0.41 LF/SF	1.04	16 *F	779 Btu/h
Windows	219 SF	0.20 CFM/LF	1.16 LF/SF	1.04	16 *F	920 Btu/h
Ventilation	0 cfm			1.04	16 *F	0 Btu/h
						8,665 Btu/h

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE 4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	0	0.24	20	1.0	0 Btu/hr
East Exposure	-204	0.24	39	1.0	-1,886 Btu/hr
South Exposure	0	0.24	27	1.0	0 Btu/hr
West Exposure	-204	0.24	22	1.0	-1,064 Btu/hr
Roof	2,425	0.17	73	0.0	0 Btu/hr
					-2,950 Btu/h

INTERNAL HEAT GAINS

Lights	0.70 w/sf x	3,483 Occ Area =	2.4 kW x3413x		0.00 RAF =	0 Btu/h
Misc.						0 Btu/h
						0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT	
Solar	10,053
Conduction to Room	53,321
Conduction to Plenum	-2,950
Ventilaton and Infiltration	8,665
Sub Total	**69,089**

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Internal Gains to Room	12,270
Internal Gains to Plenum	0
Sub Total	**12,270**

HEAT GAIN/LOSS WORKSHEET

Project Name:	Borough of Ocean Gate	Project No.:	CHA #21611		
Location	Ocean Gate, NJ	Site Elevation:	460 Feet	Specific Volume	14.00 CF/#
Building Name	Fire Hall	Date:	06/18/10		
Engineer:	Matt Pittinger				

Building/Facility Designation: Fire Hall

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	2,017 SF	0.14 CFM/SF	4,629	0.0042 #/#	5,545 Btu/h
Doors	526 SF	0.20 CFM/LF	4,629	0.0042 #/#	848 Btu/h
Windows	219 SF	0.20 CFM/LF	4,629	0.0042 #/#	1,001 Btu/h
Ventilation	0 cfm		4,629	0.0042 #/#	0 Btu/h
People	10 people	0.15 time in space		250 Btu/hr/person	375 Btu/h
					7,770 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	
Temperature Dependent Gains	69,089	7,770	76,860	
Temperature Indep. Gains	12,270		12,270	SHR= 0.91
Total	81,359	7,770	89,130	

Building Cooling Load: 7.4 Tons at 469 SF/Ton

Building Air Flow to Condition Space based on a 12*F Temp Rise is: **6,731 CFM** / **1.93 CFM/sf**

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	646	0.24	66	10,028 Btu/h
East Exposure	554	0.24	66	8,602 Btu/h
South Exposure	597	0.24	66	9,270 Btu/h
West Exposure	554	0.24	66	8,602 Btu/h
Fenestration	219	1.05	66	15,075 Btu/h
Roof	2,425	0.17	66	26,748 Btu/h
Doors	526	0.14	66	4,812 Btu/h
Ceiling	3,483	0.14	10	4,838 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	2,425	0.04	20	1,940 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	2,351 SF	0.14 CFM/SF	1.04	66	329 cfm	22,501 Btu/h
Doors	526 SF	0.20 CFM/LF	1.04	66	43 cfm	2,954 Btu/h
Windows	219 SF	0.20 CFM/LF	1.04	66	51 cfm	3,486 Btu/h
Ventilation Load	0 cfm		1.04	66	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					423 cfm	28,941 Btu/h

Building Heating Load	118,856	btu/h
	34.1	btu/sf

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	3.0	7.0	1	21.0	20.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	21.0	20.0
East	11.0	11.0	2	242.0	88.0
				0.0	0.0
				0.0	0.0
			Sub-total	242.0	88.0
South	3.0	7.0	1	21.0	20.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	21.0	20.0
West	11.0	11.0	2	242.0	88.0
				0.0	0.0
			Sub-total	242.0	88.0
			Total	**526.0**	**216.0**

LF/SF
0.41

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	59.0	12.0	1	708.0	142.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	59.0			708.0	142.0	12.0	Average height wall automatically linked to
East	53.0	12.0	1	636.0	130.0		
	34.0	6.0	1	204.0	80.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	87.0			840.0	210.0	9.7	Average height wall automatically linked to
South	59.0	12.0	1	708.0	142.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	59.0			708.0	142.0	12.0	Average height wall automatically linked to
West	53.0	12.0	1	636.0	130.0		
	34.0	6.0	1	204.0	80.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	87.0			840.0	210.0	9.7	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	2.5	4.2	2	21.2	27.0	
	2.5	4.0	2	20.0	26.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	41.2	53.0	
East	2.5	4.3	1	10.6	13.5	
	2.5	3.8	1	9.4	12.5	
	3.0	4.0	2	24.0	28.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	44.0	54.0	
South	3.5	5.0	4	70.0	68.0	
	2.5	4.0	2	20.0	26.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	90.0	94.0	
West	2.5	4.3	1	10.6	13.5	
	2.5	3.8	1	9.4	12.5	
	3.0	4.0	2	24.0	28.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	44.0	54.0	
						LF/SF
			Total	**219.2**	**255.0**	1.16

Borough of Ocean Gate
CHA #21611
Building: Fire Hall

Reconcile Thermal Model

Building Footprint	3,483	SF	Ex Occupied Clng Temp.	74	*F	Ex Occupied Htg Temp.	70 *F
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	74	*F	Ex Unoccupied Htg Temp.	70 *F
Cooling Efficiency	0.00	kW/ton	Occupied Cooling UA	(3,777)	btu/hr/*F	Occupied Heating UA	1,373 btu/hr/*F
Internal Gains	12,270	btu/h	Unoccupied Cooling UA	(3,148)	btu/hr/*F	Unoccupied Heating UA	1,373 btu/hr/*F
Unoc Internal Gain factor	0.05		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb		
Ave Occ Internal Gain Factor	0.7		Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb		
Economizer available (Y/N)	No						

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS									
					Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Available Economizer Cooling kWh	Necessary Cooling Energy kWh	Existing Cooling Energy kWh	Existing Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	M
102.5	49.1	0	0	0	-107,630	-41,145	-8,589	-89,723	-41,145	-613	0	0	0	0
97.5	42.5	3	0	3	-88,748	-28,573	-8,589	-73,982	-28,573	-613	0	0	0	0
92.5	39.5	34	2	32	-69,865	-22,858	-8,589	-58,241	-22,858	-613	0	0	0	0
87.5	36.6	131	6	125	-50,983	-17,334	-8,589	-42,500	-17,334	-613	0	0	0	0
82.5	34.0	500	24	476	-32,100	-12,382	-8,589	-26,760	-12,382	-613	0	0	0	0
77.5	31.6	620	30	590	-13,218	-7,810	-8,589	-11,019	-7,810	-613	0	0	0	0
72.5	29.2	664	32	632	0	0	-8,589	0	0	-613	0	0	0	0
67.5	27.0	854	41	813	3,432	1,143	-8,589	3,432	1,143	-613	0	0	0	0
62.5	24.5	927	44	883	10,296	3,429	-8,589	10,296	3,429	-613	0	0	0	148
57.5	21.4	600	29	571	17,159	5,715	-8,589	17,159	5,715	-613	0	0	0	164
52.5	18.7	610	29	581	24,023	8,000	-8,589	24,023	8,000	-613	0	0	0	237
47.5	16.2	611	29	582	30,887	10,286	-8,589	30,887	10,286	-613	0	0	0	307
42.5	14.4	656	31	625	37,750	12,572	-8,589	37,750	12,572	-613	0	0	0	404
37.5	12.6	1,023	49	974	44,614	14,858	-8,589	44,614	14,858	-613	0	0	0	748
32.5	10.7	734	35	699	51,478	17,144	-8,589	51,478	17,144	-613	0	0	0	620
27.5	8.6	334	16	318	58,342	19,430	-8,589	58,342	19,430	-613	0	0	0	321
22.5	6.8	252	12	240	65,205	21,715	-8,589	65,205	21,715	-613	0	0	0	271
17.5	5.5	125	6	119	72,069	24,001	-8,589	72,069	24,001	-613	0	0	0	149
12.5	4.1	47	2	45	78,933	26,287	-8,589	78,933	26,287	-613	0	0	0	61
7.5	2.6	22	1	21	85,796	28,573	-8,589	85,796	28,573	-613	0	0	0	31
2.5	1.0	13	1	12	92,660	30,859	-8,589	92,660	30,859	-613	0	0	0	20
-2.5	0.0	0	0	0	99,524	33,145	-8,589	99,524	33,145	-613	0	0	0	0
-7.5	-1.5	0	0	0	106,388	35,431	-8,589	106,388	35,431	-613	0	0	0	0
TOTALS		8,760	417	8,343								0	0	3,480

Existing Building Ventilation & Infiltration (occ)	**423 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc)	**423 cfm**
Economizer Ventilation (from AHU's)	**0 cfm**

Energy Use Indices (calculated)

	Base Case
Heating	3,480
Target ->	3,518
	98.9%

	Base Case
Cooling	0
Target ->	300
	0.0%