TOWNSHIP OF KEARNY
FIRE STATION No. 4
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

CHA PROJECT NO. 20711

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Prepared by:

CLOUGH HARBOUR & ASSOCIATES LLP

6 Campus Drive
Parsippany, NJ 07054

(973) 538-2120

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for Fire Station No. 4. The station leases approximately 5,500 square feet of a one story facility in Kearny NJ. The building does not have a basement. The facility is occupied by fire station personnel and an area consisting of a satellite police dispatch center and police offices. The apparatus area is about 20 ft high. The occupied areas have dropped ceilings with high dead spaces above them. The spaces consist of a dorm area, recreation room, kitchen, exercise room, and restrooms.

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 consumptions while increasing comfort.

2.0 EXECUTIVE SUMMARY

This report details the results of the energy audit for Fire Station No. 4, located in Kearny, New Jersey. The 5,500 square foot facility consists of a fire station and satellite police dispatch center. The following areas were evaluated for energy conservation measures:

- Infrared garage heaters
- Lighting replacements with occupancy sensors
- Insulation upgrades
- Domestic hot water heater replacement
- Door seals

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Measures which are recommended for implementation have a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of $7,500 for the recommended ECMs may be realized with a payback of 3.5 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-2 Install Infrared Garage Heaters

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
9,200	(0.3)	(1,650)	1,200	1,500	1.9	NA	6.1	NA

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

ECM-7 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
19,500	5.3	42,990	0	6,000	3.6	2,600	3.3	2.8

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

3.0 EXISTING CONDITIONS

3.1 Building General

Fire Station No. 4 currently leases the building space it occupies, which is approximately half of a single story building constructed in the 1980s. Since its original construction, the building has not undergone any significant renovations. Fire Station No. 4 houses a dispatch area, social room, kitchen, dorm area, exercise room, and three bay garage areas, about 20 ft high. The building has no basement.

The walls are constructed of decorative concrete blocks and are insulated in the occupied spaces. The roof is flat and lightly insulated. The building has only a few windows, which are double pane with metal frames.

The building is occupied 24 hours per day, every day by about four to six staff members.

3.2 Utility Usage

The building use electricity, natural gas, municipal water, and is connected to the municipal sewage system.

Electricity and natural gas are purchased from the Public Service Electric and Gas Company (PSE&G). For 2008, the facility consumed 120,300 kWh of electricity at an annual cost of about $18,700. The annual natural gas usage for the station was about 6,530 therms at a cost of $9,500.

Water usage was not available; however, the building is not charged for water use.

The largest portion of the utility bill is for electricity and the average blended rate is $0.15 per kWh. Electricity trends higher during the summer. The majority of natural gas is used to heat the building as indicated by the higher usage trends during the colder months. The average blended rate for natural gas was $1.45 per therm.

Utility data is provided in Appendix A.

As noted, electricity and natural gas commodity supply and delivery is presently purchased from PSE&G. 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.

3.3 HVAC Systems

The heating and cooling for the building's occupied areas is provided by two roof mounted gas heating and electric cooling packaged HVAC units. The garage is heated with a single gas fired unit heater manufactured by Renzor. Cooling is not provided for the garage. One air handler serves the exercise room and the other air handler serves the remaining living spaces.

3.4 Domestic Hot Water Systems

Domestic hot water is produced in a new 40 gallon gas fired hot water heater located above the ceiling.

3.5 Lighting/Electrical Systems

The lighting system within the building is manually controlled by individual switches in the spaces. The lighting in most of the building, including the garage area, firemen's dormitory area, and satellite police area is mandated to be on 24/7 for safety reasons. In the rest of the building, the lighting is turned on and off by occupants. The lights in these spaces remain on about 12 hours a day. Most of the lighting is fluorescent using inefficient F34T12 34 watt lamps. The lighting in the garage area, however, is provided by about 16- 250 watt high pressure sodium high bay fixtures as well as about three energy saver 8' T12 fixtures. All exit signs within the building have been upgraded to LED technology. The building's exterior lighting is provided by utility owned light fixtures located on telephone poles.

3.6 Control Systems

Each air handler is controlled with its own programmable thermostat. The exercise room's heating temperature is set to 65°F. The temperature in the apparatus area is controlled by a wall mounted thermostat. Since the building is occupied 24 hours per day, the indoor temperature is constantly maintained.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Increase Ceiling Insulation

According to construction drawing, the existing roof has 2" of insulation. The "dead" space above the dropped ceiling is not insulated. The noninsulated ceiling tiles can significantly increase the energy consumption of a building associated with space heating or cooling.

Heat conduction through the ceiling and roof is a function of the resistance to heat flow and the difference between the indoor and outdoor temperature. Adding thermal insulation increases the structural resistance to sensible heat transfer and lowers the space-heating load.

This ECM proposes to install new batt insulation rated at R-24 above the ceiling tiles. Installing ceiling insulation will reduce heat loss or gain to the space and save energy.

The amount of heat conduction through ceilings and roofs is proportional to its overall heat transfer coefficient (commonly called the U factor) and the temperature difference between the conditioned space and its surroundings. It has been calculated that the building will save about 620 therms of natural gas and 270 kWh of electricity.

Insulation has an expected life of 24 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 9,840 therms and 4,320 kWh, totaling $14,400.

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

ECM-1 Increase Ceiling Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
9,700	0	180	410	600	0.5	NA	16.2	NA

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

This measure is not recommended.

4.2 ECM-2 Install Infrared Garage Heaters

There is a single unit heater in the garage that provides heating for the garage. This measure proposes that the existing gas fired unit be replaced with infrared gas-fired heaters. Infrared heaters distribute heat more effectively and have high burner efficiencies.

For calculation purposes, a separate block load calculation was used for the garages. It was determined that the existing garage area requires approximately 4,360 therms of energy to meet the annual heating load. The proposed infrared heaters have burner efficiencies of 85% and transfer heat more effectively. Repeating the energy consumption calculation with the proposed values and calculating the difference in energy consumptions between the existing and proposed models yielded an annual natural gas savings of about 1,200 therms.

To implement this measure three infrared units are proposed to be installed above each garage door. This measure will require the installation of additional natural gas piping, flue piping, and minor electrical modifications. Flue stacks for the heaters can be combined per the manufacturer's installation instructions. The quantity, size, and capacity of the heaters were used for estimating purposes.

Infrared heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 21,600 therms and (29,700) kWh, totaling $27,000.

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

ECM-2 Install Infrared Garage Heaters

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
9,200	(0.3)	(1,650)	1,200	1,500	1.9	NA	6.1	NA

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

This measure is recommended.

4.3 ECM-3 Replace Domestic Hot Water Heater

Domestic hot water (DHW) is produced in a 40 gallon gas fired hot water heater. The unit appears to be relatively new; however, due to low demand for hot water, there are extended periods with little or no use when the unit must still heat the water within the storage tank. This measure evaluates the replacement of the existing unit with a tankless, on demand, gas-fired, condensing hot water heater. This measure would eliminate standby losses as well as increase the efficiency of producing the hot water; therefore, this would decrease the consumption of the natural gas. The new tankless unit would be installed in place of the existing unit above the dropped ceiling. Installation would require some modifications to fuel piping and installation of a flue venting system. The proposed efficiency of the new DHW heater is based on the Takagi T-H1 on demand tankless gas fired hot water heater. The annual gas savings were estimated at 70 therms.

On demand hot water heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 1,260 therms, totaling $1,800.

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

ECM-3 Replace Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
5,400	0	0	70	100	(0.7)	300	>25	>25

* Incentive shown per the New Jersey Smart Start Program 2010 Gas Water Heating Application.

This measure is not recommended.

4.4 ECM-4 Install Door Seals

The back door leading from the recreation room to the outside has a large gap on the bottom of the door, which allows air to infiltrate into the room causing heat transfer. The HVAC systems have to expend more thermal energy to offset this infiltration. Door sealing is easy to install and this analysis assumes that a new threshold will be provided to stop the airflow.

The measure determined the perimeter length and gap spacing of the doors. Infiltration reductions and the associated energy savings were then calculated by using weather bin heating and cooling hour data.

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 200 kWh and 300 therms, totaling $300.

4.5 ECM-5 Lighting Replacements

The building contains approximately 70 fluorescent fixtures with inefficient T-12 lamps. Each fixture is equipped with either two - 4' lamps, or two – 2' u-tube lamps that are powered with magnetic ballasts. Overall energy consumption can be reduced by retrofitting the existing T-12 fixtures with more efficient T-8 fluorescent lamps and electronic ballasts.

The lighting within the garage utilizes 250 watt high pressure sodium high bay fixtures. The energy consumption of this lighting can be reduced by replacing the 250 watt fixtures with 150 watt induction light high bay fixtures. Induction lighting is a fairly new technology, and an induction lighting specialist should be consulted for the design of a high pressure sodium fixture replacement.

To compute the annual savings for this ECM, the energy consumption of the lighting fixtures was established, and it was determined to be 105,280 kWh per year. To calculate the annual energy consumption utilizing T-8 lamp and ballast retrofits and replacement induction fixtures, the proposed fixture power requirement was used with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. Calculations are provided in Appendix F.

Existing lamps and ballasts of each fixture would be replaced with electronic ballast T-8 fluorescent lamps, the length and quantity varies based on application. Incandescent bulbs would also be replaced with compact fluorescent bulbs. This ECM will provide annual savings of 37,710 kWh.

The lighting retrofits have an expected life of 15 years, according to the manufacturers, and total energy savings over the life of the project are estimated at 565,650 kWh and $81,000.

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

ECM-5 Lighting Replacements

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
18,400	5.3	37,710	0	5,400	3.4	2,500	3.4	2.9

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

This measure is not recommended in lieu of ECM-7.

4.6 ECM-6 Install Occupancy Sensors

Lighting fixtures throughout the building are manually switched on and off, and are operational with occupancy. The lighting within most of the building remains on 24/7; within the remaining spaces, approximately 12 hours a day. The operating time of many of the building's interior lighting fixtures can be reduced by installing occupancy sensors, including recreation, restroom, kitchen, and some office areas. Occupancy sensors were not considered for many areas due to safety concerns.

Applying the same process used in the calculation of ECM-5, the existing baseline energy consumption for each fixture was determined. Typical traffic patterns for each space were then taken into account to approximate the actual occupancy hours per day. It was established that the annual energy consumption of the lighting fixtures can be reduced by 7,920 kWh. Approximately nine occupancy sensors and some standard electrical work are required for this measure.

Lighting controls have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 118,800 kWh, and $15,000.

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

ECM-6 Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,100	0.0	7,920	0	1,000	12.6	200	1.1	0.9

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

This measure is not recommended in lieu of ECM-7.

4.7 ECM-7 Lighting Replacements with Occupancy Sensors

This measure is a combination of ECMs 5 and 6 to allow for maximum energy and demand reduction. Due to interactive effects, the energy and cost savings for occupancy sensors and lighting upgrades are not cumulative.

The lighting retrofits and controls have an expected lifetime of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 644,850 kWh, and $90,000.

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

ECM-7 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
19,500	5.3	42,990	0	6,000	3.6	2,600	3.3	2.8

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance and Smart Start Programs

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. Facilities that meet this criterion must also achieve a minimum performance target of 15% by using the EPA Portfolio Manager benchmarking tool before and after construction. Incentives for this program are in three parts. Incentive #1 energy reduction plan pays $0.05 per square foot to a maximum of $25,000 or 50% of facility annual energy cost paid after approval of application. Incentive #2 is paid after installation of recommended measures; base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost. Incentive #3 post-construction benchmarking is paid after acceptance of a report proving energy savings over one year utilizing the 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 $1.8/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 minimum performance target calculated with the EPA Portfolio Manager benchmarking tool not to exceed 50% of total project cost.

A new incentive structure is in place for projects exceeding 20% in energy savings, which doubles incentives #2 and #3 for a total of $0.36/kWh and $3.60/therm. For Incentive #1, the maximum incentive has been raised to 80% of project costs, or $2 million per gas account and $2 million per electric account. The 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. This new incentive structure has been extended to December 31, 2010.

Specific incentives for energy conservation measures were calculated on an individual basis utilizing the 2009 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 usage and savings to be applied towards the Pay for Performance incentive. A project is not applicable for incentives in both programs.

5.1.2 PSE&G Small Business Direct Install Program

PSE&G has a new Small Business Direct Install Program, and the following information was obtained from the current PSE&G customer service website. Small business and not-for-profit customers residing in the municipalities noted in the following listing, which includes Kearny, may be eligible to participate in the PSE&G Direct Install Program.

Bayonne	Gloucester City	**Kearny**	Orange	Plainfield
Camden	Guttenberg	Mt. Holly	Passaic	Roselle
Carteret	Hillside	New Brunswick	Paterson	Trenton
East Orange	Irvington	Newark	Pemberton	Union City
Elizabeth	Jersey City	North Bergen	Perth Amboy	West New York

PSE&G is offering this program to customers designated by the State of New Jersey as having "Urban Enterprise Zones". Program guidelines require that customers be a PSE&G customer of record with a separately metered PSE&G electric or gas account; must have a qualifying energy usage profile - an average electric demand of 200 kW or less, or 40,300 kWh or less per month (the kW limit is waived for municipalities); and have a satisfactory payment history with PSE&G. Customers who lease their business are eligible for program participation; however, landlord permission is required.

As part of the PSE&G Direct Install Program, participants can obtain a free on-site energy audit of electrical equipment, proposal based on the audit with recommended energy efficiency measures; and installation of energy-saving equipment. PSE&G pays 100% of the cost to install the recommended energy efficiency measures. The customer is required to repay 20% of the total cost interest free, over two years as part of their PSE&G bill. The measures eligible for participation in this program are subject to approval by PSE&G.

Eligible energy efficiency equipment upgrades include:

- Lighting retrofits including sensors and controls
- Refrigeration, motors, and HVAC
- Site-specific custom projects

5.2 Building Incentives

Fire Station No. 4 is eligible for several incentives available under the New Jersey Smart Start Programs. The total amount of all qualified incentives is about $2,900 and includes installing a tankless water heater and upgrades to the lighting system.

When calculating the total incentive for the New Jersey Pay For Performance program, all energy conservation measures are applicable as the amount received is based on building wide energy improvements. Since the overall energy reduction for the building is estimated to exceed the 15% minimum, the building is eligible for Incentives #2 and #3 as previously discussed. This would result in a total incentive of about $21,100, reducing the total project payback from 5.3 years to 2.8 years. See Appendix I for calculations.

Under PSE&G's direct install program, the station is potentially eligible to receive $43,900, and would be required to repay $8,800. Incentives cannot be accepted under multiple programs.

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 two gas-fired air handlers with DX cooling to meet the HVAC requirements. This 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 completely removed and a low temperature closed loop water source 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.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The fire station 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 large solar cell array. 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 $1.00/watt up to 50 kW of installed PV array. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes; therefore, 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 period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is $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 2009 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 36.2 kW and a minimum of 21.8 kW in 2008. The monthly average over the observed 12 month period was 28.5 kW. The existing load does not justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 25 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 currently $10 per watt or $10,000 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 – 25 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
250,000	0	29,580	0	4,600	4,600	25,000	14,400	>25	11.8

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $1.00 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

While this measure is currently not recommended, future increases in the cost of electricity may make the payback period more attractive.

6.2.2 Solar Thermal Hot Water Plant

Active solar thermal systems use solar collectors to gather the sun's energy to heat water, another fluid, 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, 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 fired hot water heater and, therefore, this measure would offer natural gas savings.

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, the Township of Kearny does not pay Federal taxes and, therefore, would not benefit from this program.

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

Solar Thermal Domestic Hot Water Plant

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$	$	$	Years	Years
27,100	0	0	150	200	200	NA	>25	NA

* No incentive is available in New Jersey at this time.

This measure is not recommended.

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 is, therefore, 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 Kearny area, the map indicates a mean annual wind speed of 10 miles per hour. For the fire station, there are site restrictions. Parking lots, trees and surrounding structures would greatly affect a tower location.

A wind speed map is included in Appendix L.

This measure is not recommended due to the low mean annual wind speed and site restrictions.

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 fire station has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter, thermal usage during the summer months is low. Thermal energy produced by the CHP plant in the warmer months will be wasted. 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 because of noise issues, and potential zoning issues. Additionally, the fire station does not have a steady biomass waste stream to fuel the power generation system.

6.6 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the PSE&G 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 PSE&G offers incentives 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 during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

A PSE&G pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The town of Kearny fire station No. 4 had a monthly average electricity demand of 28.5 kW and a maximum demand of 36.2 kW in 2008.

This measure is not recommended because the facility does not have adequate load to meet the required minimum load reduction.

7.0 EPA PORTFOLIO MANAGER

The United States 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 station is considered a high energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 193 kBTU/ft^2/year. Several factors contribute to the unfavorable EUI, including, wasted energy from poor ceiling insulation, inefficient unit heater operation, inefficient lighting operation, etc. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 137 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because the building type (fire station/police station) is currently not eligible for an energy star rating.

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

The user name and password for the Fire No. 4's EPA Portfolio Manager Account has been provided to Gerry Kerr of the Township of Kearny.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at Fire Station No. 4, in Kearny, New Jersey identified potential ECMs for lighting upgrades with occupancy sensors and domestic hot water heater replacement. Potential annual savings of $7,500 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-2 Install Infrared Garage Heaters

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
9,200	(0.3)	(1,650)	1,200	1,500	1.9	NA	6.1	NA

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

ECM-7 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
19,500	5.3	42,990	0	6,000	3.6	2,600	3.3	2.8

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

APPENDIX A

Utility Usage Analysis

New Jersey BPU Energy Audit Program
CHA Project No.: 20711
Town of Kearny
PSE&G - Electric Service

Fire Dept. #4 - Hackensack Ave. Bldg 42A
Account No.: 11 280 263 41
Meter No.: 726003684

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-08	6,725	17.3	$815.09	$91.20	$723.89	0.1212	0.1076	5.27
February-08	7,853	21.8	$986.48	$124.35	$862.13	0.1256	0.1098	5.70
March-08	7,457	18.5	$939.17	$111.58	$827.59	0.1259	0.1110	6.03
April-08	6,907	21.5	$873.18	$123.26	$749.92	0.1264	0.1086	5.73
May-08	7,779	25.8	$979.23	$140.01	$839.22	0.1259	0.1079	5.43
June-08	8,683	30.3	$1,496.16	$414.57	$1,081.59	0.1723	0.1246	13.68
July-08	12,123	30.7	$2,209.54	$484.24	$1,725.30	0.1823	0.1423	15.77
August-08	12,958	31.7	$2,387.81	$495.36	$1,892.45	0.1843	0.1460	15.63
September-08	11,183	27.4	$2,101.29	$447.54	$1,653.75	0.1879	0.1479	16.33
October-08	7,846	24.1	$1,261.05	$237.01	$1,024.04	0.1607	0.1305	9.83
November-08	7,121	21.3	$1,045.28	$226.84	$818.44	0.1468	0.1149	10.65
December-08	7,384	17.9	$1,042.74	$213.60	$829.14	0.1412	0.1123	11.93
Most Recent Yr	104,019	31.7	$16,137.02	$3,109.56	$13,027.46	0.1551	0.1252	10.79

Fire Dept #4 - Hackensack Ave. - Tower
Account No.: 11 280 448 03
Meter No.: 626044285

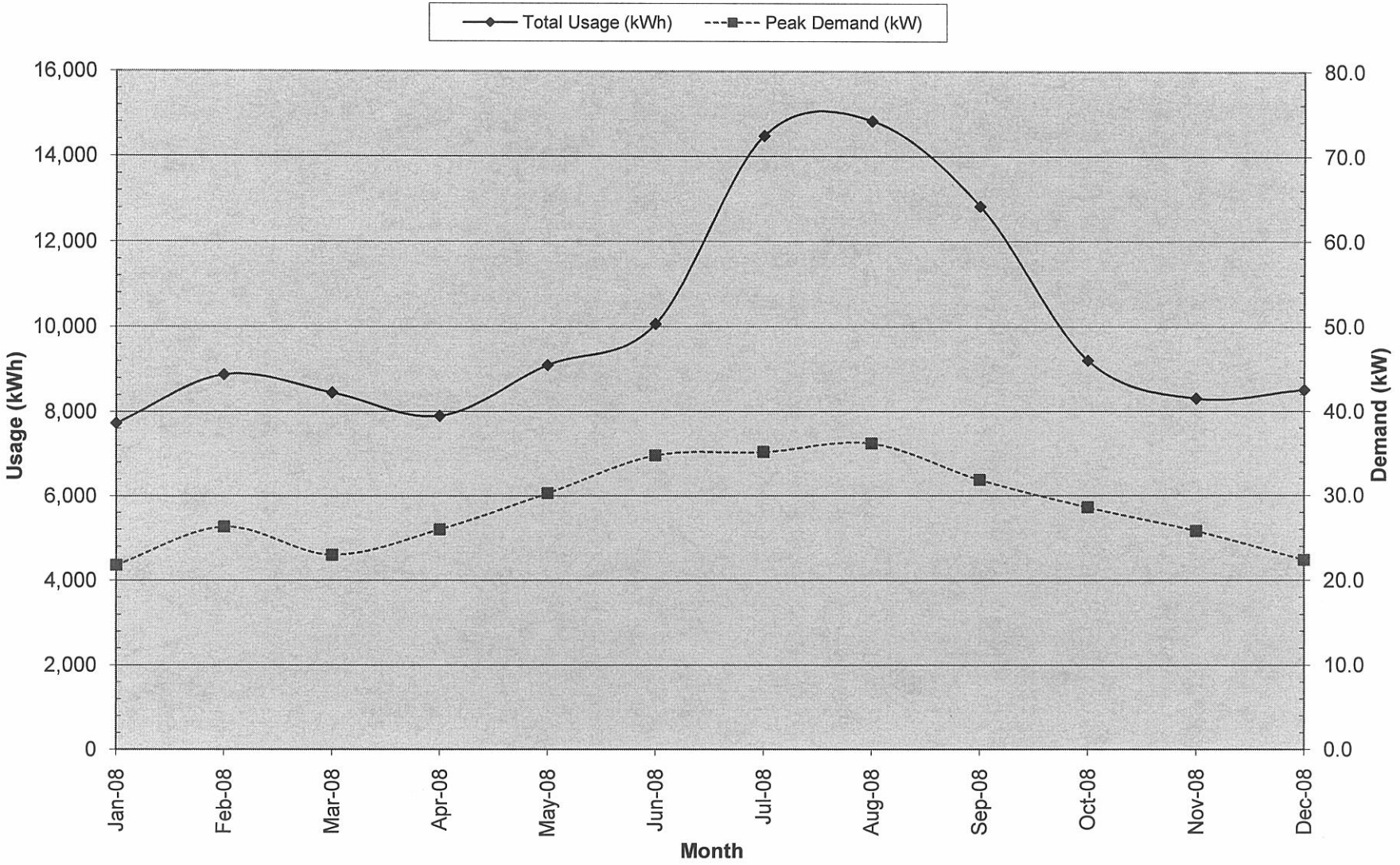
			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-08	1,002	4.5	$137.71					
February-08	1,022	4.5	$141.52					
March-08	992	4.5	$139.43	$25.65	$113.78	0.1406	0.1147	5.70
April-08	989	4.5	$136.64	$25.65	$110.99	0.1382	0.1122	5.70
May-08	1,318	4.5	$171.36	$25.65	$145.71	0.1300	0.1106	5.70
June-08	1,383	4.5	$238.91	$63.07	$175.84	0.1727	0.1271	14.02
July-08	2,358	4.5	$410.00	$71.43	$338.57	0.1739	0.1436	15.87
August-08	1,870	4.5	$348.17	$71.43	$276.74	0.1862	0.1480	15.87
September-08	1,653	4.5	$319.50	$71.43	$248.07	0.1933	0.1501	15.87
October-08	1,361	4.5	$220.11	$38.97	$181.14	0.1617	0.1331	8.66
November-08	1,184	4.5	$178.70	$39.08	$139.62	0.1509	0.1179	8.68
December-08	1,125	4.5	$168.98	$39.08	$129.90	0.1502	0.1155	8.68
Most Recent Yr	16,257	4.5	$2,611.03	$471.44	$1,860.36	0.1606	0.1144	8.73

* Electric bills not available for shaded months.

Total (Both Meters):

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-08	7,727	21.8	$952.80	$117.45	$835.35	0.1233	0.1081	5.39
February-08	8,875	26.3	$1,128.00	$149.98	$978.02	0.1271	0.1102	5.70
March-08	8,449	23.0	$1,078.60	$137.23	$941.37	0.1277	0.1114	5.97
April-08	7,896	26.0	$1,009.82	$148.91	$860.91	0.1279	0.1090	5.73
May-08	9,097	30.3	$1,150.59	$165.66	$984.93	0.1265	0.1083	5.47
June-08	10,066	34.8	$1,735.07	$477.64	$1,257.43	0.1724	0.1249	13.73
July-08	14,481	35.2	$2,619.54	$555.67	$2,063.87	0.1809	0.1425	15.79
August-08	14,828	36.2	$2,735.98	$566.79	$2,169.19	0.1845	0.1463	15.66
September-08	12,836	31.9	$2,420.79	$518.97	$1,901.82	0.1886	0.1482	16.27
October-08	9,207	28.6	$1,481.16	$275.98	$1,205.18	0.1609	0.1309	9.65
November-08	8,305	25.8	$1,223.98	$265.92	$958.06	0.1474	0.1154	10.31
December-08	8,509	22.4	$1,211.72	$252.68	$959.04	0.1424	0.1127	11.28
Most Recent Yr	120,276	36.2	$18,748.05	$3,632.88	$15,115.17	0.1559	0.1257	10.61

Electric Usage - Town of Kearny Fire Dept. #4



Utility Data - KearnyFire #4(rev-0).xls
Electricity Chart

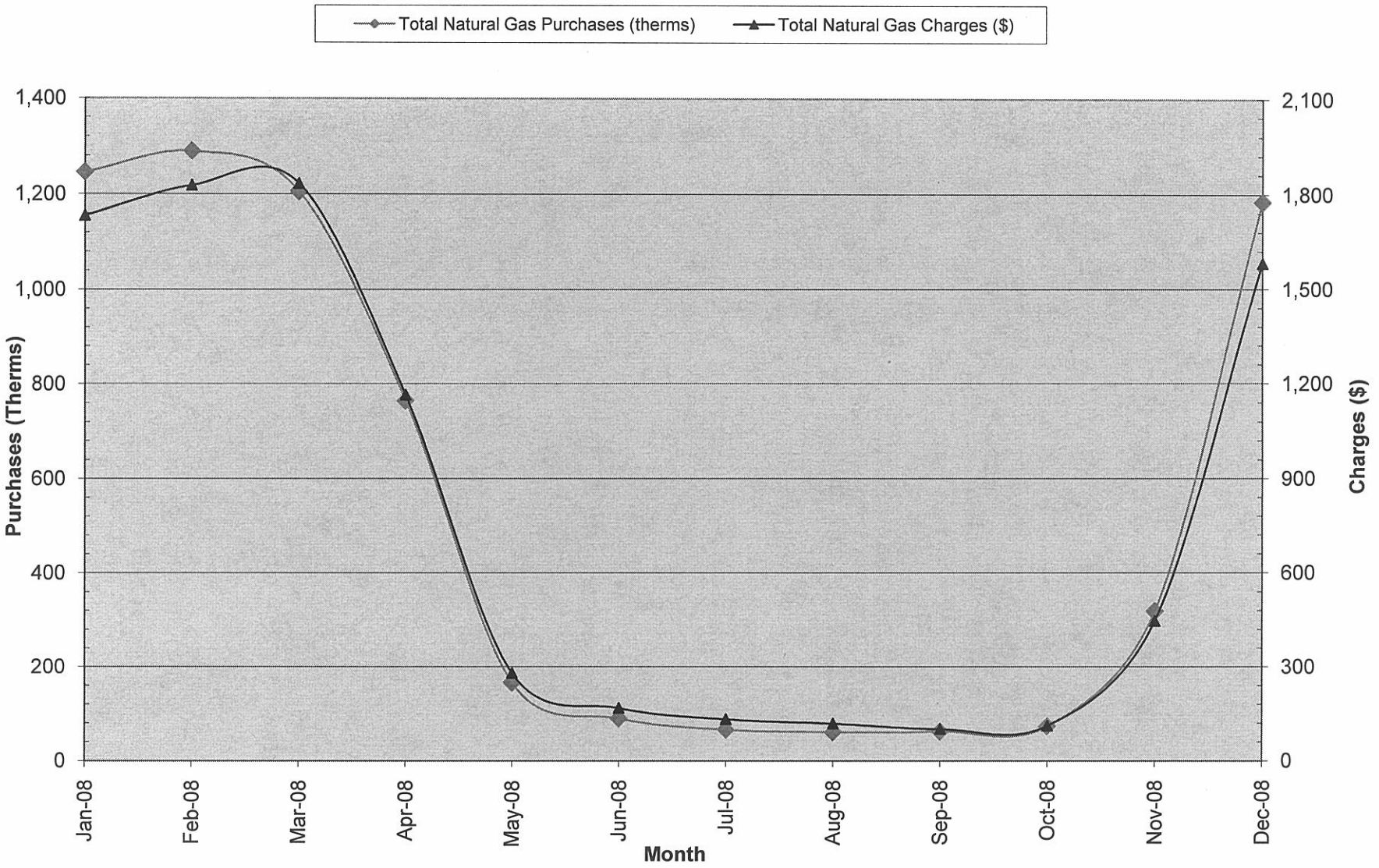
New Jersey BPU Energy Audit Program
CHA Project No.: 20711
Town of Kearny
PSE&G - Natural Gas Service

Fire Dept. #4 - Hackensack Ave. Bldg 42A
Account No.: 11 280 263 41
Meter No.: 126003684

Month	Therms	Charges ($)	($/Therm)
January-08	1,246	1,732.72	1.391
February-08	1,290	1,827.19	1.417
March-08	1,206	1,833.35	1.520
April-08	765	1,164.83	1.523
May-08	166	279.56	1.684
June-08	90	168.01	1.874
July-08	66	132.10	2.010
August-08	61	118.42	1.951
September-08	62	101.14	1.637
October-08	73	111.64	1.524
November-08	319	447.15	1.402
December-08	1,184	1,582.57	1.336

Most Recent Yr	6,527	9,499	1.455

Natural Gas Usage - Town of Kearny Fire Dept. #4



Utility Data - KearnyFire #4(rev-0).xls
Natural Gas Chart

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

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

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

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

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

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

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

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

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

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

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Jan 14, 2009

APPENDIX B

ECM-1 Increase Ceiling Insulation

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-1 Increase Ceiling Insulation

Existing Roof Area	3,984	sf
Existing U-value	0.08	Btu/hr/(sf*F)
Proposed R-value	37	
Proposed U-value	0.03	Btu/hr/(sf*F)
Heating System Efficiency	76%	
Cooling System Efficiency	1.20	kW/ton

Existing Cooling

Existing Cooling Load Temp Diff.	73	F
Existing Max. Roof Cooling Load	33,692	Btu/hr

Proposed Cooling

Proposed Cooling Load	11,838	Btu/hr
Occupied Cooling Setpoint	74	F
Unoccupied Cooling Setpoint	80	F

Existing Heating

Existing Heating Load Temp Diff.	56	F
Existing Max. Roof Heating Load	25,846	Btu/hr

Proposed Heating

Proposed Heating Load	9,081	Btu/hr
Occupied Heating Setpoint	70	F
Unoccupied Heating Setpoint	60	F

Existing Heating Total	48,269,225	Btu/yr
Proposed Heating Total	16,959,457	Btu/yr
Savings	31,309,767	Btu/yr
Input	412	**therms**
Existing Cooling Total	272	kWh/yr
Proposed Cooling Total	96	kWh/yr
Savings	177	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	8,734	3,069	-	-	6,895	2,423	-	-	-	-	-	-
97.5	3	3	0	7,202	2,530	-	-	5,363	1,884	-	-	2	-	1	-
92.5	34	34	0	5,670	1,992	-	-	3,831	1,346	-	-	19	-	7	-
87.5	131	131	0	4,137	1,454	-	-	2,298	808	-	-	54	-	19	-
82.5	500	500	0	2,605	915	-	-	766	269	-	-	130	-	46	-
77.5	620	620	0	1,073	377	-	-	-	-	-	-	67	-	23	-
72.5	664	664	0	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	854	0	-	-	766	269	-	-	-	-	-	654,295	-	229,888
62.5	927	927	0	-	-	2,298	808	-	-	-	-	-	2,130,674	-	748,615
57.5	600	600	0	-	-	3,831	1,346	-	-	766	269	-	2,298,462	-	807,568
52.5	610	610	0	-	-	5,363	1,884	-	-	2,298	808	-	3,271,477	-	1,149,438
47.5	611	611	0	-	-	6,895	2,423	-	-	3,831	1,346	-	4,213,080	-	1,480,271
42.5	656	656	0	-	-	8,428	2,961	-	-	5,363	1,884	-	5,528,566	-	1,942,469
37.5	1,023	1,023	0	-	-	9,960	3,499	-	-	6,895	2,423	-	10,189,080	-	3,579,947
32.5	734	734	0	-	-	11,492	4,038	-	-	8,428	2,961	-	8,435,354	-	2,963,773
27.5	334	334	0	-	-	13,025	4,576	-	-	9,960	3,499	-	4,350,222	-	1,528,456
22.5	252	252	0	-	-	14,557	5,115	-	-	11,492	4,038	-	3,668,345	-	1,288,878
17.5	125	125	0	-	-	16,089	5,653	-	-	13,025	4,576	-	2,011,154	-	706,622
12.5	47	47	0	-	-	17,622	6,191	-	-	14,557	5,115	-	828,212	-	290,994
7.5	22	22	0	-	-	19,154	6,730	-	-	16,089	5,653	-	421,385	-	148,054
2.5	13	13	0	-	-	20,686	7,268	-	-	17,622	6,191	-	268,920	-	94,485
-2.5	0	0	0	-	-	22,218	7,806	-	-	19,154	6,730	-	-	-	-
-7.5	0	0	0	-	-	23,751	8,345	-	-	20,686	7,268	-	-	-	-
TOTALS	**8,760**	**8,760**	**0**									**272**	**48,269,225**	**96**	**16,959,457**

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-1 Increase Ceiling 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.		
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
Install 24" wide 8" insulation	3,984	sf	$ 1.34	$ 0.50		$ 5,232	$ 2,410	$ -	$ 7,642	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

Install over dropped ceiling

7,642	Subtotal
764	10% Contingency
1,261	Contractor 15% O&P
$ -	Engineering
$ 9,667	**Total**

APPENDIX C

ECM-2 Install Infrared Garage Heaters

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-2 Install Infrared Garage Heaters

Building Footprint	2,016	SF	Ex Occupied Htg Temp.	70	*F
Steam Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	60	*F
Building Balance Temp.	60	*F	Occupied Heating UA	654	btu/hr/°F
Internal Gains	7,393	btu/h	Unoccupied Heating UA	654	btu/hr/°F
Unoc Internal Gain factor	0.03				
Ave Occ Internal Gain Factor	0.7				
Existing Heating Efficiency	78%				
Existing Heat Distribution Effectiveness	75%				
Proposed Burner Efficiency	85%				
Proposed Heat Distribution Effectiveness	95%				

Heating Energy Savings	**1,201**	**Therms/yr**
Electric Energy Savings	**(1,649)**	**kWh/yr**
Electric Demand Savings	**(0.28)**	**kW**

					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 Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49.1	0	0	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
97.5	42.5	3	3	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
92.5	39.5	34	34	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
87.5	36.6	131	131	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
82.5	34.0	500	500	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
77.5	31.6	620	620	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
72.5	29.2	664	664	0	0	0	-5,175	0	0	-222	0	0	-5,175	0	0	-222	0	0
67.5	27.0	854	854	0	1,635	2,964	-5,175	0	0	-222	1,635	2,964	-5,175	0	0	-222	0	0
62.5	24.5	927	927	0	4,905	8,892	-5,175	0	0	-222	4,905	8,892	-5,175	0	0	-222	137	99
57.5	21.4	600	600	0	8,175	14,820	-5,175	1,635	787	-222	8,175	14,820	-5,175	1,635	787	-222	183	132
52.5	18.7	610	610	0	11,446	20,748	-5,175	4,905	2,360	-222	11,446	20,748	-5,175	4,905	2,360	-222	282	204
47.5	16.2	611	611	0	14,716	26,677	-5,175	8,175	3,934	-222	14,716	26,677	-5,175	8,175	3,934	-222	378	274
42.5	14.4	656	656	0	17,986	32,605	-5,175	11,446	5,507	-222	17,986	32,605	-5,175	11,446	5,507	-222	509	369
37.5	12.6	1,023	1,023	0	21,256	38,533	-5,175	14,716	7,081	-222	21,256	38,533	-5,175	14,716	7,081	-222	955	692
32.5	10.7	734	734	0	24,526	44,461	-5,175	17,986	8,655	-222	24,526	44,461	-5,175	17,986	8,655	-222	801	580
27.5	8.6	334	334	0	27,797	50,389	-5,175	21,256	10,228	-222	27,797	50,389	-5,175	21,256	10,228	-222	417	302
22.5	6.8	252	252	0	31,067	56,317	-5,175	24,526	11,802	-222	31,067	56,317	-5,175	24,526	11,802	-222	354	257
17.5	5.5	125	125	0	34,337	62,245	-5,175	27,797	13,375	-222	34,337	62,245	-5,175	27,797	13,375	-222	195	141
12.5	4.1	47	47	0	37,607	68,173	-5,175	31,067	14,949	-222	37,607	68,173	-5,175	31,067	14,949	-222	81	59
7.5	2.6	22	22	0	40,877	74,102	-5,175	34,337	16,522	-222	40,877	74,102	-5,175	34,337	16,522	-222	41	30
2.5	1.0	13	13	0	44,147	80,030	-5,175	37,607	18,096	-222	44,147	80,030	-5,175	37,607	18,096	-222	26	19
-2.5	0.0	0	0	0	47,418	85,958	-5,175	40,877	19,670	-222	47,418	85,958	-5,175	40,877	19,670	-222	0	0
-7.5	-1.5	0	0	0	50,688	91,886	-5,175	44,147	21,243	-222	50,688	91,886	-5,175	44,147	21,243	-222	0	0
TOTALS		**8,760**	**8,760**	**0**													**4,359**	**3,158**

Existing Building Ventilation & Infiltration (occ)	**1,098**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**291**	**cfm**

Unit Heater Fan Savings

		Voltage	Load	Existing	Existing	Proposed	Existing #	Proposed #	Existing	Proposed	Annual	Existing Use	Proposed Use	Savings
#	Description		Factor	HP	Efficiency	FLA	of Units	of Units	kW	kW	Hours	kWh	kWh	kWh
UH-1	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	5,954	237	0	237
Infrared	Blower Motor	120	0.8	0.000	82.5%	1.1		3	0.00	0.32	5,954	0	1,886	(1,886)
Total				0.055			1	3	0.04	0.32		237	1886	**(1,649)**

Kearny NJ
CHA #20711
Fire Station No. 4

Garage Base Case

Garage Building Footprint	2,016	SF	Ex Occupied Htg Temp.	70	*F
Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	60	*F
Building Balance Temp.	60	*F	Occupied Heating UA	654	btu/hr/°F
Internal Gains	7,393	btu/h	Unoccupied Heating UA	654	btu/hr/°F
Unoc Internal Gain factor	0.03				
Ave Occ Internal Gain Factor	0.7				
Existing Heating Efficiency	78%				
Existing Heat Distribution Effectiveness	75%				

Heating Energy Consumption	4,359	Therms/yr

					EXISTING LOADS						
					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	Existing Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	M
102.5	49.1	0	0	0	0	0	-5,175	0	0	-222	0
97.5	42.5	3	3	0	0	0	-5,175	0	0	-222	0
92.5	39.5	34	34	0	0	0	-5,175	0	0	-222	0
87.5	36.6	131	131	0	0	0	-5,175	0	0	-222	0
82.5	34.0	500	500	0	0	0	-5,175	0	0	-222	0
77.5	31.6	620	620	0	0	0	-5,175	0	0	-222	0
72.5	29.2	664	664	0	0	0	-5,175	0	0	-222	0
67.5	27.0	854	854	0	1,635	2,964	-5,175	0	0	-222	0
62.5	24.5	927	927	0	4,905	8,892	-5,175	0	0	-222	137
57.5	21.4	600	600	0	8,175	14,820	-5,175	1,635	787	-222	183
52.5	18.7	610	610	0	11,446	20,748	-5,175	4,905	2,360	-222	282
47.5	16.2	611	611	0	14,716	26,677	-5,175	8,175	3,934	-222	378
42.5	14.4	656	656	0	17,986	32,605	-5,175	11,446	5,507	-222	509
37.5	12.6	1,023	1,023	0	21,256	38,533	-5,175	14,716	7,081	-222	955
32.5	10.7	734	734	0	24,526	44,461	-5,175	17,986	8,655	-222	801
27.5	8.6	334	334	0	27,797	50,389	-5,175	21,256	10,228	-222	417
22.5	6.8	252	252	0	31,067	56,317	-5,175	24,526	11,802	-222	354
17.5	5.5	125	125	0	34,337	62,245	-5,175	27,797	13,375	-222	195
12.5	4.1	47	47	0	37,607	68,173	-5,175	31,067	14,949	-222	81
7.5	2.6	22	22	0	40,877	74,102	-5,175	34,337	16,522	-222	41
2.5	1.0	13	13	0	44,147	80,030	-5,175	37,607	18,096	-222	26
-2.5	0.0	0	0	0	47,418	85,958	-5,175	40,877	19,670	-222	0
-7.5	-1.5	0	0	0	50,688	91,886	-5,175	44,147	21,243	-222	0
TOTALS		8,760	8,760	0							4,359
			6,808								

Existing Building Ventilation & Infiltration (occ)	1,098	cfm
Overheat Ventilation Factor	1.00	
Additional ventilation to offset overheat	0	cfm
Existing Building Ventilation & Infiltration (unocc)	291	cfm

HEAT GAIN/LOSS WORKSHEET

Project Name:	Keamy NJ	**Project No.:**	CHA #20711		
Location		**Site Elevation:**	460 Feet	**Specific Volume**	14.00 CF/#
Building Name	Fire Station No. 4	**Date:**			
Engineer:	ND				

Building/Facility Designation Garage

Outdoor Winter Design DB Temperature	14 *F	**Indoor Winter Design DB Temperature**	64 *F
Outdoor Summer Design DB Temperature	91 *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	12" CMU (on two sides)	4.0	

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	Dropped ceiling, metal deck, 2" insulation, balast	13.00	

Windows (Select One)

		U Value
	Aluminum Frame, 1/8" SP Glazing	1.05
x	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	2,016 SF		
Occupied Area	2,016 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	48 Ft	16.0 Ft	15.5 Ft	0 SF	0 SF	768 SF
East Exposure	42 Ft	16.0 Ft	15.5 Ft	0 SF	0 SF	672 SF
South Exposure	48 Ft	16.0 Ft	15.5 Ft	0 SF	0 SF	768 SF
West Exposure	42 Ft	16.0 Ft	15.5 Ft	0 SF	504 SF	168 SF

Forced Ventilation 806 cfm

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF		Shade Coef	Cooling Load Factor		Solar Heat Gain	
North Exposure	0	38	btu/h/sf	0.8	0.75	Glass Type C	0 Btu/hr	
East Exposure	0	216	btu/h/sf	0.8	0.31	Glass Type C	0 Btu/hr	
South Exposure	0	109	btu/h/sf	0.8	0.58	Glass Type C	0 Btu/hr	
West Exposure	0	216	btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr	
								0 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	744	0.25	20 *F	1.0	3,720 Btu/hr	
East Exposure	651	0.25	39 *F	1.0	6,347 Btu/hr	
South Exposure	744	0.25	27 *F	1.0	5,022 Btu/hr	
West Exposure	147	0.25	22 *F	1.0	809 Btu/hr	
Roof	2,016	0.08	73 *F	1.0	11,321 Btu/hr	
Fenestration	0	0.60	17 *F		0 Btu/hr	
Doors	504	0.50	27 *F		6,804 Btu/hr	
Ceiling	2,016	0.14	0 *F		0 Btu/hr	
Partition		0.05	0 *F		0 Btu/hr	
Floor	2,016	0.04	0 *F		0 Btu/hr	
						34,022 Btu/h

INTERNAL HEAT GAINS

								Room Heat Gain	
Lights	0.80	w/sf x	2,016	Occ Area =	1.6	kW x 3.4x	1.0 RAF =	5,504 Btu/h	
Plug Load	0.25	w/sf x	2,016	Occ Area =	0.5	kW x 3.4x	1.0 RAF =	1,720 Btu/h	
People	2	people x	255	btu/person x	33%	time in space =		168 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	
									7,393 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain	
Walls	2,286 SF	0.10	CFM/SF			1.04	17 *F	4,381 Btu/h	
Doors	504 SF	0.30	CFM/LF	0.36	LF/SF	1.04	17 *F	1,031 Btu/h	
Windows	0 SF	0.20	CFM/LF	1.17	LF/SF	1.04	17 *F	0 Btu/h	
Ventilation	806 cfm					1.04	17 *F	15,454 Btu/h	
									20,866 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	24	0.25	20	1.0	120 Btu/hr	
East Exposure	21	0.25	39	1.0	205 Btu/hr	
South Exposure	24	0.25	27	1.0	162 Btu/hr	
West Exposure	21	0.25	22	1.0	116 Btu/hr	
Roof	2,016	0.08	73	0.0	0 Btu/hr	
						602 Btu/h

INTERNAL HEAT GAINS

							Room Heat Gain	
Lights	0.80	w/sf x	2,016	Occ Area =	1.6	kW x3413x	0.00 RAF =	0 Btu/h	
Misc.								0 Btu/h	
									0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT	
Solar	0
Conduction to Room	34,022
Conduction to Plenum	602
Ventilaton and Infiltration	20,866
Sub Total	55,491

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Internal Gains to Room	7,393
Internal Gains to Plenum	0
Sub Total	7,393

LATENT COOLING LOADS

Infiltration

			Infiltration Factor		Air Density	Humidity Ratio Dif.		Room Heat Gain	
Walls	2,106	SF	0.10	CFM/SF	4,629	0.0042	##	4,136	Btu/h
Doors	504	SF	0.30	CFM/LF	4,629	0.0042	##	1,057	Btu/h
Windows	0	SF	0.20	CFM/LF	4,629	0.0042	##	0	Btu/h
Ventilation	806	cfm			4,629	0.0042	##	15,836	Btu/h
People	2	people	0.33	time in space		250	Btu/hr/person	165	Btu/h
									21,194 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	55,491	21,194	76,685		
Temperature Indep. Gains	7,393		7,393	SHR=	0.75
Total	62,884	21,194	84,077		

Building Cooling Load 7.0 Tons at 288 SF/Ton

Building Air Flow to Condition Space based on a 12*F Temp Rise is **4,972 CFM** / **2.47 CFM/sf**

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain	
North Exposure	768	0.25	6	1,152	Btu/h
East Exposure	672	0.25	6	1,008	Btu/h
South Exposure	768	0.25	50	9,600	Btu/h
West Exposure	168	0.25	50	2,100	Btu/h
Fenestration	0	0.60	50	0	Btu/h
Roof	2,016	0.08	50	7,754	Btu/h
Doors	504	0.50	28	7,056	Btu/h
Ceiling	2,016	0.14	0	0	Btu/h
Partition	0	0.05	0	0	Btu/h
Floor	2,016	0.04	50	4,032	Btu/h

Ventilation and Infiltration

			Infiltration Factor		Coef	Temp. Difference	Air Flow		Room Heat Gain	
Walls	2,376	SF	0.10	CFM/SF	1.04	50	238	cfm	12,400	Btu/h
Doors	504	SF	0.30	CFM/LF	1.04	50	54	cfm	2,808	Btu/h
Windows	0	SF	0.20	CFM/LF	1.04	50	0	cfm	0	Btu/h
Ventilation Load	806	cfm			1.04	50	806	cfm	45,453	Btu/h
Total Ventilation & Infiltration Load							1,098	cfm	60,662	Btu/h

Building Heating Load **93,363** **btu/h**

46.3 btu/sf

Kearny NJ
CHA #20711
Building: Fire Station No. 4

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	3.5	7.0	1	24.5	21.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
			Sub-total	24.5	21.0		
East				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
			Sub-total	0.0	0.0		
South	6.0	7.0	1	42.0	26.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
			Sub-total	42.0	26.0		
West	12.0	14.0	3	504.0	156.0		
				0.0	0.0		76.8%
			Sub-total	504.0	156.0		
						LF/SF	
			Total	**570.5**	**203.0**	0.36	

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	100.0	16.0	1	1600.0	232.0		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	
	100.0			1600.0	232.0	16.0	Average height wall automatically linked to
East	60.0	16.0	1	960.0	152.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	60.0			960.0	152.0	16.0	Average height wall automatically linked to
South	100.0	16.0	1	1600.0	232.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	100.0			1600.0	232.0	16.0	Average height wall automatically linked to
West	60.0	16.0	1	960.0	152.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	60.0			960.0	152.0	16.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
East				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
South	4.0	3.0	1	12.0	14.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	12.0	14.0	
West				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
						LF/SF
			Total	**12.0**	**14.0**	1.17

Kearny NJ
CHA #20711
Fire Station No. 4

ECM-2 Install Infrared Garage Heaters

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.		
						$ -	$ -	$ -	$ -	
Demo	1	ea		$ 300		$ -	$ 363	$ -	$ 363	
NG Infrared Tube Heater garage area (50MBH)	3	ea	$ 920	$ 158		$ 2,705	$ 574	$ -	$ 3,278	
Miscellaneous Gas Piping, Valves, etc.	1	ls	$ 420	$ 880		$ 412	$ 1,065	$ -	$ 1,476	
4" Class B Vent Piping	30	lf	$ 6.70	$ 10		$ 197	$ 363	$ -	$ 560	
4" Chimney Cap	3	ea	$ 11	$ 10		$ 32	$ 36	$ -	$ 69	
Roof Flashing	3	ea	$ 28	$ 10		$ 82	$ 36	$ -	$ 119	
T-stats (w/setback, control wiring)	3	ea	$ 95	$ 30		$ 279	$ 109	$ -	$ 388	
Electric wiring for ignition	3	ea	$ 30	$ 90		$ 88	$ 327	$ -	$ 415	

Note: Unit selections and budgetary pricing are per Reznor VR series infrared tube heaters.
Install one above each door

$6,668	Subtotal
$1,334	20% Contingency
$1,200	15% Contractor O&P
$0	0% Engineering
$9,202	**Total**

APPENDIX D

ECM-3 Replace Domestic Hot Water Heater

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-3 Replace DHW Heater

Summary

* Replace 180 MBH, 40 Gal Gas-Fired DHW Heater w/ Instantaneous, Condensing, Gas-Fired DHW Heater

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	21	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	25,680	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	80%		Per manufacturer nameplate
Total Annual Hot Water Demand (w/ standby losses)	20,544	MBTU/yr	
Existing Tank Size	40	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	10	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	120	°F	Per building personnel
Room Temperature	70	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.5	MBH	
Annual Standby Hot Water Load	4,563	MBTU/yr	
New Tank Size	0	Gallons	Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Hot Water Piping System Capacity	10	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	120	°F	
Room Temperature	70	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.1	MBH	
Annual Standby Hot Water Load	913	MBTU/yr	
Total Annual Hot Water Demand	16,894	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Proposed Fuel Use	184	Therms	Standby Losses and inefficient DHW heater eliminated
Utility Cost	$1.45	$/Therm	
Existing Operating Cost of DHW	$372	$/yr	
Proposed Operating Cost of DHW	$267	$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Therms/yr	73	$105

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-3 Replace DHW Heater

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.		
						$ -	$ -	$ -	$ -	
Gas-Fired DHW Heater Removal	1	LS		$ 50		$ -	$ 61	$ -	$ 61	
						$ -	$ -	$ -	$ -	
Instantaneous Gas-Fired DHW Heater	1	EA	$ 2,500	$ 330		$ 2,450	$ 399	$ -	$ 2,849	
Miscellaneous Electrical	1	LS	$ 150	$ 200		$ 147	$ 242	$ -	$ 389	
Venting Kit	1	EA	$ 150	$ 250		$ 147	$ 303	$ -	$ 450	
Miscellaneous Piping and Valves	1	LS	$ 150	$ 300		$ 147	$ 363	$ -	$ 510	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 4,258	Subtotal	
$ 426	10%	Contingency
$ 703	15%	Contractor O&P
$ -	0%	Engineering
$ 5,387	**Total**	

APPENDIX E

ECM-4 Install Door Seals

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-4 Install Door Seals

Existing: Doors or Door Seals result in excessive heat loss and infiltration
Proposed: Install new doors and/or weatherstripping to eliminate door infiltration

Building Footprint	6,000	SF	Ex Occupied Clng Temp.	74	*F	Ex Occupied Htg Temp.	70	*F
Heating System Efficiency	76%		Ex Unoccupied Clng Temp.	74	*F	Ex Unoccupied Htg Temp.	70	*F
Cooling System Efficiency	1.20	kW/ton	Prop Occupied Clng Temp.	74	*F	Prop Occupied Htg Temp.	70	*F
Internal Gains	23,235	btu/h	Prop Unoccupied Clng Temp.	74	*F	Prop Unoccupied Htg Temp.	70	*F
Unoc Internal Gain factor	0.03		Occupied Cooling UA	-3,394	btu/hr/°F	Occupied Heating UA	1,554	btu/hr/°F
Ave Occ Internal Gain Factor	0.7		Unoccupied Cooling UA	-3,358	btu/hr/°F	Unoccupied Heating UA	1,554	btu/hr/°F
			Cooling Occ Enthalpy Setpoint	27.5	Btu/lb			
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb			

					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 lbs	Proposed Heating Energy lbs
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	-96,727	-202,579	-16,265	-95,709	-52,269	-697	-96,727	-201,790	-16,265	-95,709	-51,480	-697	0	0	0	0
97.5	42.5	3	3	0	-79,757	-140,680	-16,265	-78,918	-36,298	-697	-79,757	-140,132	-16,265	-78,918	-35,750	-697	71	71	0	0
92.5	39.5	34	34	0	-62,788	-112,544	-16,265	-62,127	-29,039	-697	-62,788	-112,106	-16,265	-62,127	-28,600	-697	651	650	0	0
87.5	36.6	131	131	0	-45,818	-85,346	-16,265	-45,336	-22,021	-697	-45,818	-85,013	-16,265	-45,336	-21,688	-697	1,931	1,927	0	0
82.5	34.0	500	500	0	-28,848	-60,961	-16,265	-28,545	-15,729	-697	-28,848	-60,724	-16,265	-28,545	-15,492	-697	5,304	5,292	0	0
77.5	31.6	620	620	0	-11,879	-38,453	-16,265	-11,754	-9,921	-697	-11,879	-38,303	-16,265	-11,754	-9,772	-697	4,129	4,120	0	0
72.5	29.2	664	664	0	0	0	-16,265	0	0	-697	0	0	-16,265	0	0	-697	1,080	1,080	0	0
67.5	27.0	854	854	0	3,884	5,627	-16,265	3,884	1,452	-697	3,884	5,605	-16,265	3,884	1,430	-697	577	579	0	0
62.5	24.5	927	927	0	11,652	16,882	-16,265	11,652	4,356	-697	11,652	16,816	-16,265	11,652	4,290	-697	0	0	150	149
57.5	21.4	600	600	0	19,420	28,136	-16,265	19,420	7,260	-697	19,420	28,026	-16,265	19,420	7,150	-697	0	0	247	246
52.5	18.7	610	610	0	27,188	39,390	-16,265	27,188	10,163	-697	27,188	39,237	-16,265	27,188	10,010	-697	0	0	404	403
47.5	16.2	611	611	0	34,956	50,645	-16,265	34,956	13,067	-697	34,956	50,448	-16,265	34,956	12,870	-697	0	0	557	556
42.5	14.4	656	656	0	42,724	61,899	-16,265	42,724	15,971	-697	42,724	61,658	-16,265	42,724	15,730	-697	0	0	763	761
37.5	12.6	1,023	1,023	0	50,492	73,154	-16,265	50,492	18,875	-697	50,492	72,869	-16,265	50,492	18,590	-697	0	0	1,445	1,442
32.5	10.7	734	734	0	58,260	84,408	-16,265	58,260	21,779	-697	58,260	84,079	-16,265	58,260	21,450	-697	0	0	1,221	1,218
27.5	8.6	334	334	0	66,028	95,662	-16,265	66,028	24,683	-697	66,028	95,290	-16,265	66,028	24,310	-697	0	0	639	637
22.5	6.8	252	252	0	73,797	106,917	-16,265	73,797	27,587	-697	73,797	106,500	-16,265	73,797	27,170	-697	0	0	545	544
17.5	5.5	125	125	0	81,565	118,171	-16,265	81,565	30,490	-697	81,565	117,711	-16,265	81,565	30,030	-697	0	0	302	301
12.5	4.1	47	47	0	89,333	129,426	-16,265	89,333	33,394	-697	89,333	128,921	-16,265	89,333	32,890	-697	0	0	125	125
7.5	2.6	22	22	0	97,101	140,680	-16,265	97,101	36,298	-697	97,101	140,132	-16,265	97,101	35,750	-697	0	0	64	64
2.5	1.0	13	13	0	104,869	151,935	-16,265	104,869	39,202	-697	104,869	151,343	-16,265	104,869	38,610	-697	0	0	41	41
-2.5	0.0	0	0	0	112,637	163,189	-16,265	112,637	42,106	-697	112,637	162,553	-16,265	112,637	41,470	-697	0	0	0	0
-7.5	-1.5	0	0	0	120,405	174,443	-16,265	120,405	45,010	-697	120,405	173,764	-16,265	120,405	44,330	-697	0	0	0	0
TOTALS		8,760	8,760	0													13,743	13,718	6,503	6,486

Existing Building Ventilation & Infiltration	2,084	cfm
Existing Unocc. Building Ventilation & Infiltration	538	cfm
Door infiltration	81	cfm
Proposed reduction (10%)	8	cfm
Proposed Building Ventilation & Infiltration	2,076	cfm
Proposed Unocc. Building Ventilation & Infiltration	530	cfm

Savings		
	18	therms
	25	kWh

Kearny NJ
CHA #20711
Building: Fire Station No. 4

ECM-4 Install Door Seals

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.		
									$ -	
Threshold	1	ea	$ 50	$ 50	$ -	$ 49	$ 61	$ -	$ 110	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 110	Subtotal	
$ 11	10%	Contingency
$ 12	10%	Contractor O&P
$ -	0%	Engineering
$ 132	**Total**	

APPENDIX F

ECM-5 Lighting Replacements

Energy Audit of Kearny, NJ
CHA Project No. 20711 - Fire Station #4
ECM-5 Lighting Replacements

0 $0.125 $/kWh
$10.61 $/kW

EXISTING CONDITIONS

Field Code	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)
141	GARAGE	16	HB250HPS	HPS250/1	295	4.7	SW	8760	41,347
204	GARAGE	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	SW	8760	5,440
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145
X1	WOMENS BR	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26
6	WOMENS BR	1	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	8760	6,307
6	FIREMENS DORM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,569
6	FIREMENS DORM	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	8760	3,784
X1	FIREMENS DORM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26
6	REC RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	4368	3,774
X1	REC RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13
4	REC RM BATH	1	2T 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	2080	150
6	POLICE OPEN RM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	8760	2,523
6	POLICE OPEN RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,569
X1	POLICE OPEN RM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26
6	FIRE BATH	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599
6	POLICE BATH	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2080	300
6	VESTIBULE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261
6	POLICE RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	8760	5,046
X1	POLICE RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13
6	POLICE OFFICE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261
6	CAPT. DORM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	4368	1,258
6	CAPT. RM #2	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516
6	KITCHEN	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516
6	POLICE LOCKER RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516
	Total	**89**				**14.9**			**105,276**

RETROFIT CONDITIONS

Field Code	Area Description	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)
141	GARAGE	16	HB150IND	IND150	165	2.6	SW	8,760	23,126
204	GARAGE	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	SW	8,760	5,440
6	WEIGHT RM	5	T 28 R F 4	F44SSILL	96	0.5	SW	4,368	2,097
6	WEIGHT RM	5	T 28 R F 4	F44SSILL	96	0.5	SW	4,368	2,097
6	WEIGHT RM	5	T 28 R F 4	F44SSILL	96	0.5	SW	4,368	2,097
X1	WOMENS BR	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8,760	26
6	WOMENS BR	5	T 28 R F 4	F44SSILL	96	0.5	SW	8,760	4,205
6	FIREMENS DORM	6	T 28 R F 4	F44SSILL	96	0.6	SW	8,760	5,046
6	FIREMENS DORM	3	T 28 R F 4	F44SSILL	96	0.3	SW	8,760	2,523
X1	FIREMENS DORM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8,760	26
6	REC RM	6	T 28 R F 4	F44SSILL	96	0.6	SW	4,368	2,516
X1	REC RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8,760	13
4	REC RM BATH	1	2T 17 R F 2 (ELE)	F22ILL	33	0.0	SW	2,080	69
6	POLICE OPEN RM	2	T 28 R F 4	F44SSILL	96	0.2	SW	8,760	1,682
6	POLICE OPEN RM	6	T 28 R F 4	F44SSILL	96	0.6	SW	8,760	5,046
X1	POLICE OPEN RM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8,760	26
6	FIRE BATH	2	T 28 R F 4	F44SSILL	96	0.2	SW	2,080	399
6	POLICE BATH	1	T 28 R F 4	F44SSILL	96	0.1	SW	2,080	200
6	VESTIBULE	1	T 28 R F 4	F44SSILL	96	0.1	SW	8,760	841
6	POLICE RM	4	T 28 R F 4	F44SSILL	96	0.4	SW	8,760	3,364
X1	POLICE RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8,760	13
6	POLICE OFFICE	1	T 28 R F 4	F44SSILL	96	0.1	SW	8,760	841
6	CAPT. DORM	2	T 28 R F 4	F44SSILL	96	0.2	SW	4,368	839
6	CAPT. RM #2	4	T 28 R F 4	F44SSILL	96	0.4	SW	4,368	1,677
6	KITCHEN	4	T 28 R F 4	F44SSILL	96	0.4	SW	4,368	1,677
6	POLICE LOCKER RM	4	T 28 R F 4	F44SSILL	96	0.4	SW	4,368	1,677
	Total	**94**			**2,141**	**10**			**67,563**

COST & SAVINGS ANALYSIS

Field Code	Area Description	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
141	GARAGE	18,221	2.1	$ 2,542.43	$ 9,654.00	$1,120	3.8	3.4
204	GARAGE	-	-	$ -	$ -	$0		
6	WEIGHT RM	1,048	0.2	$ 161.60	$ 656.25	$100	4.1	3.4
6	WEIGHT RM	1,048	0.2	$ 161.60	$ 656.25	$100	4.1	3.4
6	WEIGHT RM	1,048	0.2	$ 161.60	$ 656.25	$100	4.1	3.4
X1	WOMENS BR	-	-	$ -	$ -	$0		
6	WOMENS BR	2,102	0.2	$ 293.36	$ 656.25	$100	2.2	1.9
6	FIREMENS DORM	2,523	0.3	$ 352.03	$ 787.50	$120	2.2	1.9
6	FIREMENS DORM	1,261	0.1	$ 176.01	$ 393.75	$60	2.2	1.9
X1	FIREMENS DORM	-	-	$ -	$ -	$0		
6	REC RM	1,258	0.3	$ 193.92	$ 787.50	$120	4.1	3.4
X1	REC RM	-	-	$ -	$ -	$0		
4	REC RM BATH	81	0.0	$ 15.11	$ 101.25	$10	6.7	6.0
6	POLICE OPEN RM	841	0.1	$ 117.34	$ 262.50	$40	2.2	1.9
6	POLICE OPEN RM	2,523	0.3	$ 352.03	$ 787.50	$120	2.2	1.9
X1	POLICE OPEN RM	-	-	$ -	$ -	$0		
6	FIRE BATH	200	0.1	$ 37.18	$ 262.50	$40	7.1	6.0
6	POLICE BATH	100	0.0	$ 18.59	$ 131.25	$20	7.1	6.0
6	VESTIBULE	420	0.0	$ 58.67	$ 131.25	$20	2.2	1.9
6	POLICE RM	1,682	0.2	$ 234.69	$ 525.00	$80	2.2	1.9
X1	POLICE RM	-	-	$ -	$ -	$0		
6	POLICE OFFICE	420	0.0	$ 58.67	$ 131.25	$20	2.2	1.9
6	CAPT. DORM	419	0.1	$ 64.64	$ 262.50	$40	4.1	3.4
6	CAPT. RM #2	839	0.2	$ 129.28	$ 525.00	$80	4.1	3.4
6	KITCHEN	839	0.2	$ 129.28	$ 525.00	$80	4.1	3.4
6	POLICE LOCKER RM	839	0.2	$ 129.28	$ 525.00	$80	4.1	3.4
	Total	**37,713**	**5.3**	**$5,387**	**$18,418**	**$2,450**		
		Demand Savings		5.3	$673			
		kWh Savings		37,713	$4,714			
		Total savings			$5,387		3.4	3.0

APPENDIX G

ECM-6 Install Occupancy Sensors

Energy Audit of Kearny, NJ

CHA Project No. 20711 - Fire Station #4

ECM-6 Install Occupancy Sensors

0 $0.125 $/kWh

$10.61 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
141	GARAGE	16	HB250HPS	HPS250/1	295	4.7	SW	8760	41,347.2	16	HB250HPS	HPS250/1	295	4.7	None	8760	41,347.2	0.0	0.0	$0.00	$0.00	$0.00		
204	GARAGE	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	SW	8760	5,440.0	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	None	8760	5,440.0	0.0	0.0	$0.00	$0.00	$0.00		
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145.0	5	T 34 R F 4 (MAG)	F44EE	144	0.7	None	4368	3,145.0	0.0	0.0	$0.00	$0.00	$0.00		
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145.0	5	T 34 R F 4 (MAG)	F44EE	144	0.7	None	4368	3,145.0	0.0	0.0	$0.00	$0.00	$0.00		
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145.0	5	T 34 R F 4 (MAG)	F44EE	144	0.7	None	4368	3,145.0	0.0	0.0	$0.00	$0.00	$0.00		
55	WOMENS BR	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26.3	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	26.3	0.0	0.0	$0.00	$0.00	$0.00		
199	WOMENS BR	1	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	8760	6,307.2	5	T 34 R F 4 (MAG)	F44EE	144	0.7	None	8760	6,307.2	0.0	0.0	$0.00	$0.00	$0.00		
6	FIREMENS DORM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,568.6	6	T 34 R F 4 (MAG)	F44EE	144	0.9	None	8760	7,568.6	0.0	0.0	$0.00	$0.00	$0.00		
6	FIREMENS DORM	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	8760	3,784.3	3	T 34 R F 4 (MAG)	F44EE	144	0.4	None	8760	3,784.3	0.0	0.0	$0.00	$0.00	$0.00		
X1	FIREMENS DORM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26.3	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	26.3	0.0	0.0	$0.00	$0.00	$0.00		
6	REC RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	4368	3,774.0	6	T 34 R F 4 (MAG)	F44EE	144	0.9	OCC	2000	1,728.0	2,046.0	0.0	$255.74	$118.75	$20.00	0.5	0.4
X1	REC RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13.1	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	13.1	0.0	0.0	$0.00	$0.00	$0.00		
4	REC RM BATH	1	2T 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	2080	149.8	1	2T 34 R F 2 (u) (MAG)	FU2EE	72	0.1	OCC	2000	144.0	5.8	0.0	$0.72	$118.75	$20.00	164.9	137.2
6	POLICE OPEN RM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	8760	2,522.9	2	T 34 R F 4 (MAG)	F44EE	144	0.3	None	8760	2,522.9	0.0	0.0	$0.00	$0.00	$0.00		
6	POLICE OPEN RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,568.6	6	T 34 R F 4 (MAG)	F44EE	144	0.9	None	8760	7,568.6	0.0	0.0	$0.00	$0.00	$0.00		
X1	POLICE OPEN RM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26.3	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	26.3	0.0	0.0	$0.00	$0.00	$0.00		
6	FIRE BATH	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599.0	2	T 34 R F 4 (MAG)	F44EE	144	0.3	OCC	1000	288.0	311.0	0.0	$38.88	$118.75	$20.00	3.1	2.5
6	POLICE BATH	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2080	299.5	1	T 34 R F 4 (MAG)	F44EE	144	0.1	OCC	1000	144.0	155.5	0.0	$19.44	$118.75	$20.00	6.1	5.1
6	VESTIBULE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261.4	1	T 34 R F 4 (MAG)	F44EE	144	0.1	None	8760	1,261.4	0.0	0.0	$0.00	$0.00	$0.00		
6	POLICE RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	8760	5,045.8	4	T 34 R F 4 (MAG)	F44EE	144	0.6	OCC	6000	3,456.0	1,589.8	0.0	$198.72	$118.75	$20.00	0.6	0.5
X1	POLICE RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13.1	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	13.1	0.0	0.0	$0.00	$0.00	$0.00		
6	POLICE OFFICE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261.4	1	T 34 R F 4 (MAG)	F44EE	144	0.1	OCC	6000	864.0	397.4	0.0	$49.68	$118.75	$20.00	2.4	2.0
6	CAPT. DORM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	4368	1,258.0	2	T 34 R F 4 (MAG)	F44EE	144	0.3	OCC	2000	576.0	682.0	0.0	$85.25	$118.75	$20.00	1.4	1.2
6	CAPT. RM #2	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516.0	4	T 34 R F 4 (MAG)	F44EE	144	0.6	OCC	2000	1,152.0	1,364.0	0.0	$170.50	$118.75	$20.00	0.7	0.6
6	KITCHEN	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516.0	4	T 34 R F 4 (MAG)	F44EE	144	0.6	OCC	2000	1,152.0	1,364.0	0.0	$170.50	$118.75	$20.00	0.7	0.6
6	POLICE LOCKER RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516.0	4	T 34 R F 4 (MAG)	F44EE	144	0.6	None	4368	2,516.0	0.0	0.0	$0.00	$0.00	$0.00		
	Total	89				14.9			105,276	94				15			97,360	7,915	0	989	$1,069	180		
																	Demand Savings			0.0	$0			
																	kWh Savings			7,915	$989			
																	Total Savings				$989		1.1	0.9

APPENDIX H

ECM-7 Lighting Replacements with Occupancy Sensors

Energy Audit of Kearny, NJ
CHA Project No. 20711 - Fire Station #4
ECM-7 Lighting Replacements with Occupancy Sensors

0 $0.125 $/kWh
$10.61 $/kW

	EXISTING CONDITIONS									RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
141	GARAGE	16	HB250HPS	HPS250/1	295	4.7	SW	8760	41,347	16	HB150IND	IND150	165	2.6	None	8,760	23,126	18,221	2.1	$ 2,542.43	$ 9,654.00	$ 1,120	3.8	3.4
204	GARAGE	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	SW	8760	5,440	3	S 96 C F 2 (MAG) 8'	F82EHE	207	0.6	None	8,760	5,440	-	-	$ -	$ -	$ -		
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145	5	T 28 R F 4	F44SSILL	96	0.5	None	4,368	2,097	1,048	0.2	$ 161.60	$ 656.25	$ 100	4.1	3.4
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145	5	T 28 R F 4	F44SSILL	96	0.5	None	4,368	2,097	1,048	0.2	$ 161.60	$ 656.25	$ 100	4.1	3.4
6	WEIGHT RM	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	4368	3,145	5	T 28 R F 4	F44SSILL	96	0.5	None	4,368	2,097	1,048	0.2	$ 161.60	$ 656.25	$ 100	4.1	3.4
55	WOMENS BR	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	26	-	-	$ -	$ -	$ -		
199	WOMENS BR	1	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	8760	6,307	5	T 28 R F 4	F44SSILL	96	0.5	None	8,760	4,205	2,102	0.2	$ 293.36	$ 656.25	$ 100	2.2	1.9
6	FIREMENS DORM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,569	6	T 28 R F 4	F44SSILL	96	0.6	None	8,760	5,046	2,523	0.3	$ 352.03	$ 787.50	$ 120	2.2	1.9
6	FIREMENS DORM	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	8760	3,784	3	T 28 R F 4	F44SSILL	96	0.3	None	8,760	2,523	1,261	0.1	$ 176.01	$ 393.75	$ 60	2.2	1.9
X1	FIREMENS DORM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	26	-	-	$ -	$ -	$ -		
6	REC RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	4368	3,774	6	T 28 R F 4	F44SSILL	96	0.6	OCC	2,000	1,152	2,622	0.3	$ 364.41	$ 906.25	$ 140	2.5	2.1
X1	REC RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	13	-	-	$ -	$ -	$ -		
4	REC RM BATH	1	2T 34 R F 2 (u) (MAG)	FU2EE	72	0.1	SW	2080	150	1	2T 17 R F 2 (ELE)	F22ILL	33	0.0	OCC	2,000	66	84	0.0	$ 15.44	$ 220.00	$ 30	14.3	12.3
6	POLICE OPEN RM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	8760	2,523	2	T 28 R F 4	F44SSILL	96	0.2	None	8,760	1,682	841	0.1	$ 117.34	$ 262.50	$ 40	2.2	1.9
6	POLICE OPEN RM	6	T 34 R F 4 (MAG)	F44EE	144	0.9	SW	8760	7,569	6	T 28 R F 4	F44SSILL	96	0.6	None	8,760	5,046	2,523	0.3	$ 352.03	$ 787.50	$ 120	2.2	1.9
X1	POLICE OPEN RM	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	26	-	-	$ -	$ -	$ -		
6	FIRE BATH	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599	2	T 28 R F 4	F44SSILL	96	0.2	OCC	1,000	192	407	0.1	$ 63.10	$ 381.25	$ 60	6.0	5.1
6	POLICE BATH	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2080	300	1	T 28 R F 4	F44SSILL	96	0.1	OCC	1,000	96	204	0.0	$ 31.55	$ 250.00	$ 40	7.9	6.7
6	VESTIBULE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261	1	T 28 R F 4	F44SSILL	96	0.1	None	8,760	841	420	0.0	$ 58.67	$ 131.25	$ 20	2.2	1.9
6	POLICE RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	8760	5,046	4	T 28 R F 4	F44SSILL	96	0.4	OCC	6,000	2,304	2,742	0.2	$ 367.17	$ 643.75	$ 100	1.8	1.5
X1	POLICE RM	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	BREAKER	8760	13	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	13	-	-	$ -	$ -	$ -		
6	POLICE OFFICE	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	8760	1,261	1	T 28 R F 4	F44SSILL	96	0.1	OCC	6,000	576	685	0.0	$ 91.79	$ 250.00	$ 40	2.7	2.3
6	CAPT. DORM	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	4368	1,258	2	T 28 R F 4	F44SSILL	96	0.2	OCC	2,000	384	874	0.1	$ 121.47	$ 381.25	$ 60	3.1	2.6
6	CAPT. RM #2	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516	4	T 28 R F 4	F44SSILL	96	0.4	OCC	2,000	768	1,748	0.2	$ 242.94	$ 643.75	$ 100	2.6	2.2
6	KITCHEN	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516	4	T 28 R F 4	F44SSILL	96	0.4	OCC	2,000	768	1,748	0.2	$ 242.94	$ 643.75	$ 100	2.6	2.2
6	POLICE LOCKER RM	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	4368	2,516	4	T 28 R F 4	F44SSILL	96	0.4	None	4,368	1,677	839	0.2	$ 129.28	$ 525.00	$ 80	4.1	3.4
	Total	89				14.9			105,276	94				9.6			62,287		5.3	6,047	19,487	2,630		
																	Demand Savings			5.3	$673			
																	kWh Savings			42,989	$5,374			
																	Total Savings				$6,047		3.2	2.8

APPENDIX I

New Jersey Pay For Performance Incentive Program

Kearny NJ
CHA #20711
Building: Fire Station No. 4

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per January, 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.

	Annual Utilities	
	kWh	Therms
Existing Usage (from utility)	120,280	6,530
Proposed Savings	41,550	1,700
Existing Total MMBtus	1,064	
Proposed Savings MMBtus	311.810	
% Reduction	29.3%	
Proposed Annual Savings	$8,230	

	≥ %15 - < 20%	
	$/kWh	$/therm
Incentive #2	$0.11	$1.10
Incentive #3	$0.07	$0.70

	≥ 20%	
	$/kWh	$/therm
Incentive #2	$0.22	$2.20
Incentive #3	$0.14	$1.40

	Incentives $		
	Elec	Gas	Total
Incentive #2	$9,141	$3,740	$12,881
Incentive #3	$5,817	$2,380	$8,197
Totals	**$14,958**	**$6,120**	**$21,078**

Total Project Cost	$43,900
% Incentives of Project Cost*	48.0%
Project Cost w/ Incentives*	$22,822

Project Payback (years)	
w/o Incentives	w/ Incentives
5.3	2.8

* Maximum allowable incentive is 80% of total project cost, or
$2 million per gas account and $2 million per electric account

APPENDIX J

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts *** AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	25.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	19.2 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.6 ¢/kWh

Results

Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	2070	322.71
2	4.05	2235	348.44
3	4.58	2711	422.64
4	4.84	2649	412.98
5	5.30	2919	455.07
6	5.33	2753	429.19
7	5.27	2780	433.40
8	5.25	2751	428.88
9	5.06	2669	416.10
10	4.46	2514	391.93
11	3.15	1794	279.68
12	2.87	1730	269.71
Year	4.46	29575	4610.74

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data 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

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.

Please send questions and comments to Webmaster Disclaimer and copyright notice.

Return to RREDC Home Page (*http://rredc.nrel.gov/*)

Township of Kearny
Fire Station No. 4

Cost of Electricity $0.156 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-25 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
$250,000	**0.0**	**29,580**	**0**	**$4,600**	**0**	**$4,600**	**$25,000**	**$14,400**	**54.3**	**11.8**

Note: Budgetary cost is based on $10,000/kW.

*Incentive based on New Jersey renewable energy program for non-residential applications(PV)= $1.00/W of installed PV system

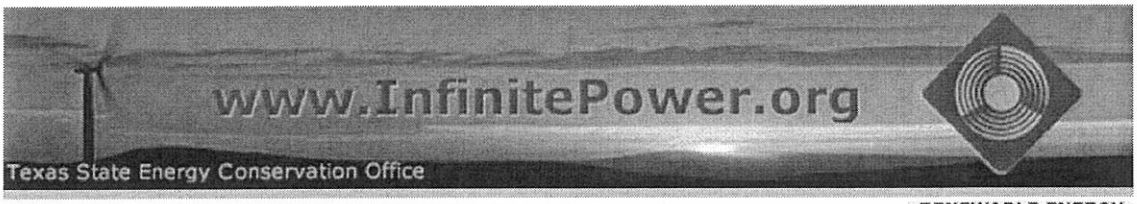
** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

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 K

Solar Thermal Domestic Hot Water Plant



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RARE

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)	55
? 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)	60
Energy Use			
1334		? 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
1668 BTU/hr	? Power Into Water Heater	1361 BTU/hr
Cost		
$ 1.455 /Therm	? Utility Rates	$ 0.1559 /kWh
$ 212.599	? Yearly Water Heating Cost	$ 544.365
How Does Solar Compare?		
? Solar Water Heater Cost: $ 27100		? Percentage Solar: 70
182.099 years for gas	? Payback Time for Solar System	71.1181 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

NJBPU Energy Audits
CHA # 20711
Township of Kearny
Fire Station No. 4

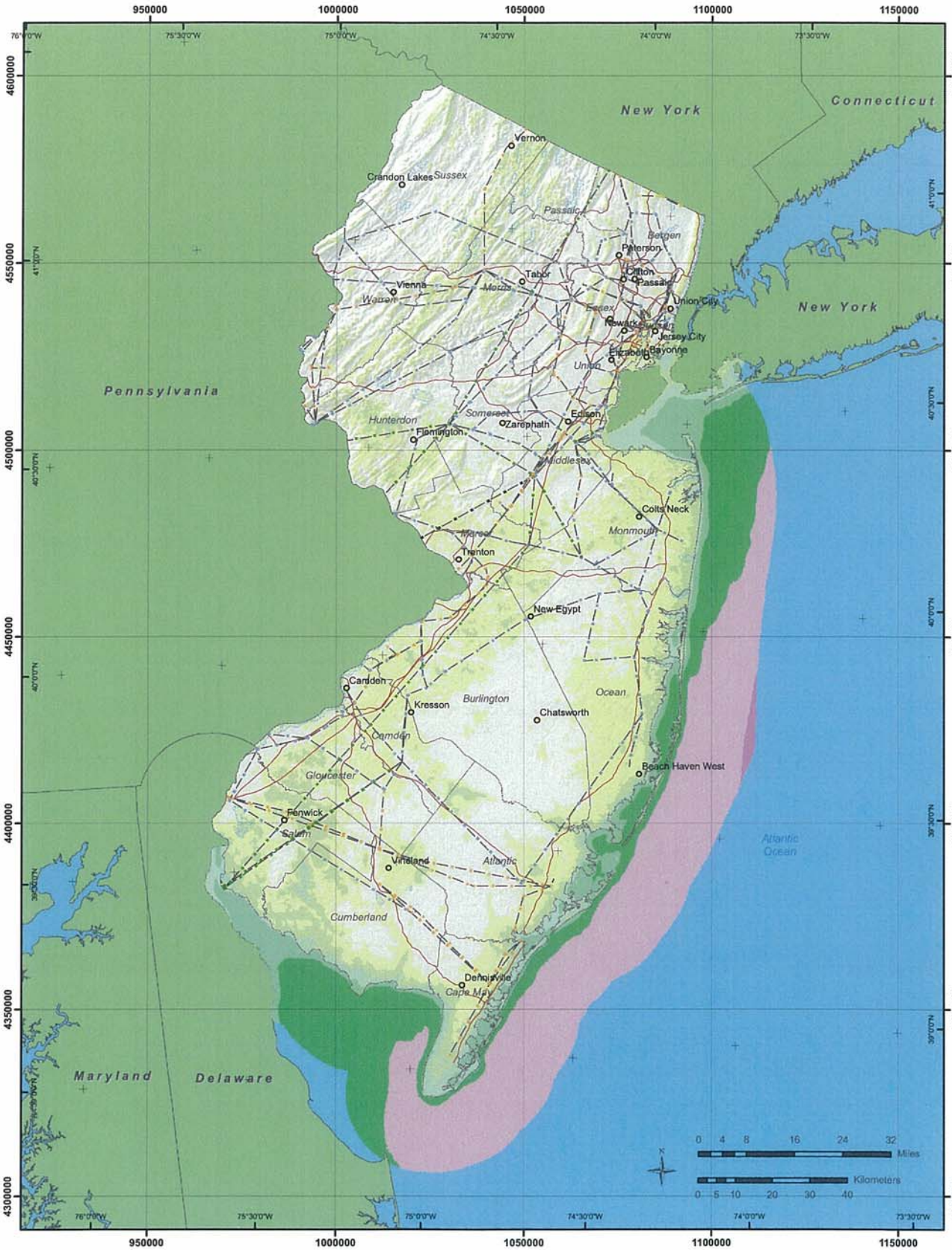
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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 GallonStorage 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 L

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	
10.1 - 11.2	4.5 - 5.0	
11.2 - 12.3	5.0 - 5.5	
12.3 - 13.4	5.5 - 6.0	
13.4 - 14.5	6.0 - 6.5	
14.5 - 15.7	6.5 - 7.0	
15.7 - 16.8	7.0 - 7.5	
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.

AWS Truewind, LCC

APPENDIX M

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Fire Department #4

Building ID: 2239947
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 16, 2010

Facility
Fire Department #4
Hackensack Ave. Bldg 42A
Kearny, NJ 07032

Facility Owner
Township of Kearny
357 Bergen Ave
Kearny, NJ 07032

Primary Contact for this Facility
Gerry Kerr
357 Bergen Ave
Kearny, NJ 07032

Year Built: 1980
Gross Floor Area (ft²): 5,500

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	410,382
Natural Gas (kBtu)[4]	652,800
Total Energy (kBtu)	1,063,182

Energy Intensity[5]	
Site (kBtu/ft²/yr)	193
Source (kBtu/ft²/yr)	373

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	97

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	138%
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) 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 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	Fire Department #4	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	Hackensack Ave. Bldg 42A, Kearny, NJ 07032	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		☐

FD #4 (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	5,500 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	4(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	168Hours(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	6(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: Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: PSE&G Electric (Bldg 42A) (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	7,384.00
11/01/2008	11/30/2008	7,121.00
10/01/2008	10/31/2008	7,846.00
09/01/2008	09/30/2008	11,183.00
08/01/2008	08/31/2008	12,958.00
07/01/2008	07/31/2008	12,123.00
06/01/2008	06/30/2008	8,683.00
05/01/2008	05/31/2008	7,779.00
04/01/2008	04/30/2008	6,907.00
03/01/2008	03/31/2008	7,457.00
02/01/2008	02/29/2008	7,853.00
01/01/2008	01/31/2008	6,725.00
PSE&G Electric (Bldg 42A) Consumption (kWh (thousand Watt-hours))		**104,019.00**
PSE&G Electric (Bldg 42A) Consumption (kBtu (thousand Btu))		**354,912.83**

Meter: PSE&G Electric (Tower) (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	1,125.00
11/01/2008	11/30/2008	1,184.00
10/01/2008	10/31/2008	1,361.00
09/01/2008	09/30/2008	1,653.00
08/01/2008	08/31/2008	1,870.00
07/01/2008	07/31/2008	2,358.00
06/01/2008	06/30/2008	1,383.00
05/01/2008	05/31/2008	1,318.00
04/01/2008	04/30/2008	989.00
03/01/2008	03/31/2008	992.00
02/01/2008	02/29/2008	1,022.00
01/01/2008	01/31/2008	1,002.00
PSE&G Electric (Tower) Consumption (kWh (thousand Watt-hours))		**16,257.00**

PSE&G Electric (Tower) Consumption (kBtu (thousand Btu))	**55,468.88**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**410,381.71**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	☐

Fuel Type: Natural Gas

Meter: PSE&G Natural Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	1,184.00
11/01/2008	11/30/2008	319.00
10/01/2008	10/31/2008	73.00
09/01/2008	09/30/2008	62.00
08/01/2008	08/31/2008	61.00
07/01/2008	07/31/2008	66.00
06/01/2008	06/30/2008	90.00
05/01/2008	05/31/2008	166.00
04/01/2008	04/30/2008	765.00
03/01/2008	03/31/2008	1,206.00
02/01/2008	02/29/2008	1,290.00
01/01/2008	01/31/2008	1,246.00

PSE&G Natural Gas Consumption (therms)	**6,528.00**
PSE&G Natural Gas Consumption (kBtu (thousand Btu))	**652,800.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**652,800.00**
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 as the PE 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
Fire Department #4
Hackensack Ave. Bldg 42A
Kearny, NJ 07032

Facility Owner
Township of Kearny
357 Bergen Ave
Kearny, NJ 07032

Primary Contact for this Facility
Gerry Kerr
357 Bergen Ave
Kearny, NJ 07032

General Information

Fire Department #4	
Gross Floor Area Excluding Parking: (ft^2)	5,500
Year Built	1980
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

FD #4	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	5,500
Number of PCs[o]	4
Weekly operating hours[o]	168
Workers on Main Shift[o]	6

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site ($kBtu/ft^2$)	193	193	0	N/A	78
Source ($kBtu/ft^2$)	373	373	0	N/A	157
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/$ft^2$/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	97	97	0	N/A	39
$kgCO_2e/ft^2$/year	18	18	0	N/A	7

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 N

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #20711
Kearny
Fire Station No.4

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy (years)
AHU1	N/A	Packaged unit. Not accesible	Gas fired heating, electric cooling	Estimated at	Roof	Bedrooms, kitchen	N/A	N/A
AHU2	N/A	Packaged unit. Not accesible	Gas fired heating, electric cooling		Roof	Gym, social room	N/A	N/A
UH1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DHWH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A