TOWNSHIP OF KEARNY
FIRE STATION No. 3
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

CHA PROJECT NO. 20711

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for Kearny Township Fire Station No. 3, in Kearny NJ. The 4,000 square foot, two story central fire station is continually operational. It consists of offices, two bay garage area, dispatch area, social room, sleeping area, kitchen, 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. 3. The 4,000 square foot central fire station located in Kearny, New Jersey, is continually operational. The two floors consist of offices, two bay garage area, dispatch area, social room, sleeping area, kitchen, and restrooms. The following areas were evaluated for energy conservation measures:

- Domestic hot water heater
- Lighting replacements
- Occupancy sensors
- Insulation upgrades
- Infrared gas fired heaters

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 $1,200 for the recommended ECMs may be realized with a payback of 6.6 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 Smart Start Buildings Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

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
7,500	4.5	2,800	(50)	800	0.9	100	9.4	9.2

* Incentives based on New Jersey Smart Start Gas Water Heating Application.

ECM-4 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
300	0.3	1,140	0	200	9.0	NA	1.5	NA

* There are no incentives based on New Jersey Smart Start Prescriptive Lighting Measures for this ECM.

ECM-5 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
300	0.0	1,010	0	200	9.0	100	1.5	1.0

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

3.0 EXISTING CONDITIONS

3.1 Building General

Fire Station No. 3 (station) is a two story building constructed in 1974, and recently a new HVAC system was installed. The first floor houses two bay apparatus garage, dispatch area, social room, sleeping area, kitchen and restrooms. The second floor is smaller and contains offices. The building does not have a basement or attic.

The building envelope is in good condition. The walls are constructed of decorative concrete block and are mostly insulated. The apparatus area's walls are not insulated. The roof is flat and insulated. All the windows are double pane with metal frames.

The first floor operates continuously, and is occupied by approximately 5-8 staff members. The offices operate nine hours per day, five days per week, and are occupied by about 10 people.

3.2 Utility Usage

The station utilizes 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). In 2008, the station consumed 132,000 kWh of electricity at an annual cost of about $22,400. Consumption of natural gas commenced in March 2008, when the station switched from electric HVAC equipment to gas fired. From March through December 2008, natural gas usage was about 1,200 therms at a cost of approximately $1,800.

Water data was not provided; however, the building is not charged for usage.

The largest portion of utility charges is for electricity, and the average blended rate is $0.16 per kWh. The electricity usage trend shows a higher consumption during the summer cooling months, due to air conditioning.

The majority of natural gas is used for heating the building as indicated by the higher usage trend during the months of November through April. The average blended rate for natural gas was $1.51 per therm.

Utility data is provided in Appendix A.

As noted, electricity and natural gas commodity supply and delivery are 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 electric HVAC system was replaced with gas fired in 2008. The station has two Trane rooftop air handlers. One unit, rated at 120MBH input and 96MBH output of gas heating and about 7.5 tons of electric cooling, serves the offices. The second Trane unit, rated at 200MBH input and 160MBH output gas heating and 10 tons of electric cooling serves the first floor, except the apparatus area. Additional

cooling for the dispatch area is provided by a split system equipped with a Trane condensing unit rated at 2 tons. The apparatus area is heated by five gas fired unit heaters. There is no cooling for the garage area. There are several fractional horsepower restroom exhaust fans are controlled by restroom light switches.

3.4 Lighting/Electrical Systems

The majority of the lighting system within the building is manually controlled by individual switches in the spaces. Occupancy sensors have been installed to control the lights in the upstairs storage room and two restrooms on the first floor, and the locker room. The lights in the front dispatch room as well as the fire engine garage remain on continually. Most of the lighting is fluorescent with F32T8 32 watt lamps; some recessed compact fluorescent spotlights are utilized. Incandescent lamps exist in the upstairs rear stairway, and first floor restrooms. All of the building exit signs utilize energy efficient LED technology with the exception of the 7.5 watt tungsten exit sign located above the back door of the fire engine garage.

The building's exterior lighting consists of metal halide, compact fluorescent spotlights, and incandescent fixtures that are controlled by timers.

3.5 Control Systems

Several programmable thermostats located through the building are connected to the new direct digital control (DDC) system. The newly installed building management system is fully capable of night setback scheduling for the offices. Temperature setpoints vary from space to space.

3.6 Domestic Hot Water Systems

Hot water is produced by an electric A.O. Smith 4500 watt hot water heater, with a tank capacity of 50 gallons.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Increase Wall Insulation

Most walls of the building are insulated; however, the east and north exterior walls of the apparatus area provide the least resistance to heat loss. It would be possible to install interior insulation for the east wall and part of the north wall. Wall insulation can be increased by installing additional 1 ½" thick rigid insulation. This task would require possible relocations or reinstallation of electrical devices attached to the walls.

To calculate the savings, the heat losses and gains through the walls were found using the existing wall assemblies' R-value and bin weather data for Newark, NJ. The values were then totaled to determine the annual heating loads. Values were then determined with a thermal resistance, R-value, which included the additional 1 ½" insulation. The combined annual energy savings of adding insulation to the ceiling is expected to be 310 therms for the station.

Insulation has an expected life of 24 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 7,440 therms, totaling $12,000.

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

ECM-1 Increase Wall Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
6,000	-	-	310	500	1.0	NA	12.0	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

Five gas-fired unit heaters, operating with a thermal efficiency of about 80%, are used to heat the garage areas of the station. This measure proposes that the existing unit heaters be replaced with infrared gas-fired heaters. Infrared heaters distribute heat more effectively, have higher burner efficiencies, and do not require an air circulation fan.

It was determined that the existing unit heaters would require approximately 2,800 therms of energy yearly. The proposed infrared heaters have an improved burner efficiency of 85% and transfer heat more effectively via radiation. The proposed case determined an annual natural gas requirement of about 2,100 therms. Changes in electricity requirements were also calculated based on the power demand of the existing and proposed units.

The total annual energy savings for this ECM would be about 700 therms with a minimal change in electrical usage of (240) kWh.

To implement this measure, some natural gas piping, flue piping, and minor electrical modifications will be necessary. Flue stacks for the heaters can be combined per the manufacturer's installation instructions.

To calculate the budgetary cost, four infrared heaters were used. The quantity, size, and capacity of the heaters were used for estimate purposes only. Exact heater selection and sizing cannot be developed without generating a heating load profile for the space.

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 (3,960) kWh and 11,880 therms, totaling $18,000.

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
13,000	(.22)	(220)	660	1,000	0.4	NA	13.0	NA

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

This measure is not recommended.

4.3 ECM-3 Replace Domestic Hot Water Heater

The existing domestic hot water heater is an electric A.O. Smith 4.5 kW, 50 gallon capacity unit. This measure evaluates replacing the existing heater with a gas fired, tankless, instantaneous, condensing domestic hot water heater. Installing a tankless heater would eliminate standby losses and utilize a more cost effective energy source.

To calculate the savings for this measure, electricity consumption by the heater was estimated based on rating and operating hours, and converted to thermal units. The standby losses were then calculated for the hot water storage tank and annual energy required to meet the hot water demand was determined. This value was then applied to the proposed water heater efficiency of 92% to determine the projected annual energy consumption. Proposed efficiency was based on the Takagi Flash T-H2 instantaneous hot water heater.

The implementation of this measure will require replacement of the existing domestic hot water heater with a new tankless, instantaneous, condensing domestic hot water heater. Additionally, new immediate water and gas piping, new venting, and electrical connections will also be required.

Instantaneous heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 49,680 kWh and (900) therms, totaling $14,400.

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

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
7,500	4.5	2,800	(50)	800	0.9	100	9.4	9.2

* Incentives based on New Jersey Smart Start Gas Water Heating Application.

This measure is recommended.

4.4 ECM-4 Lighting Replacements

The station currently utilizes nine incandescent bulbs throughout the building as well as one 7.5 watt tungsten exit sign. Overall energy consumption can be reduced by replacing the incandescent bulbs with compact fluorescent bulbs, and the tungsten sign with an LED exit sign.

To compute the annual savings for this ECM, the energy consumption of the lighting fixtures was established, and it was determined to be 32,478 kWh per year. To calculate the annual energy consumption utilizing compact fluorescent bulbs and LED technology, 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 E. This ECM will provide annual savings of 1,141 kWh.

Lighting has an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 17,100 kWh and $3,000.

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

ECM-4 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
300	0.3	1,140	0	200	9.0	NA	1.5	NA

* There are no incentives based on New Jersey Smart Start Prescriptive Lighting Measures for this ECM.

This measure is recommended.

4.5 ECM-5 Install Occupancy Sensors

Lighting fixtures in most of the spaces throughout the building are manually switched on and off, and are operational with occupancy. Lighting in the upstairs offices is operated approximately 63 hours per week; the number varies based on the space. The operating time of many of the building's interior lighting fixtures can be reduced by installing occupancy sensors in the Chief Inspector's office and Training Room. Occupancy sensors were not considered for most areas within the building due to safety concerns.

Applying the same process used in the calculation of ECM-4, 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 1,010 kWh.

Two occupancy sensors and some standard electrical work are required for this measure.

Occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 15,150 kWh and $3,000.

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

ECM-5 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
300	0.0	1,010	0	200	9.0	100	1.5	1.0

* 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

Station No. 3 is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about $200 and includes installing a gas-fired water heater and occupancy sensors.

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 $2,500, reducing the total project payback from 10.0 years to 9.1 years. See Appendix G for calculations.

Under PSE&G's direct install program, the fire station is potentially eligible to receive $27,100, and would be required to repay $5,400. 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 gas-fired rooftop units with DX cooling and gas-fired unit heaters 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 H.

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 72.0 kW and a minimum of 19.2 kW in 2008. The monthly average over the observed 12 month period was 45.3 kW. The existing load does not justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 45 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 H and summarized below:

Photovoltaic (PV) Rooftop Solar Power Generation – 45 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
450,000	0	53,240	0	9,000	9,000	45,000	25,900	>25	11.6

*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. Since the DHW is presently produced by an electric hot water heater, savings for this measure would be due to a reduction in electricity consumption.

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 I 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	2,910	0	500	500	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 and aerial site photo are included in Appendix J.

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.

6.5 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. 3 had a monthly average electricity demand of 45.3 kW and a maximum demand of 72.0 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 State Energy 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 172 kBTU/ft^2/year. Several factors contribute to the unfavorable EUI, including, wasted energy from poor wall insulation, use of an electric DHW heater, inefficient lighting operation, etc. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 144 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 K.

The user name and password for the fire station'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. 3, in Kearny, New Jersey identified potential ECMs for lighting upgrades, domestic hot water heater, and occupancy sensors. Potential annual savings of $1,200 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

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
7,500	4.5	2,800	(50)	800	0.9	100	9.4	9.2

* Incentives based on New Jersey Smart Start Gas Water Heating Application.

ECM-4 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
300	0.3	1,140	0	200	9.0	NA	1.5	NA

* There are no incentives based on New Jersey Smart Start Prescriptive Lighting Measures for this ECM.

ECM-5 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
300	0.0	1,010	0	200	9.0	100	1.5	1.0

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

APPENDIX A

Utility Usage Analysis

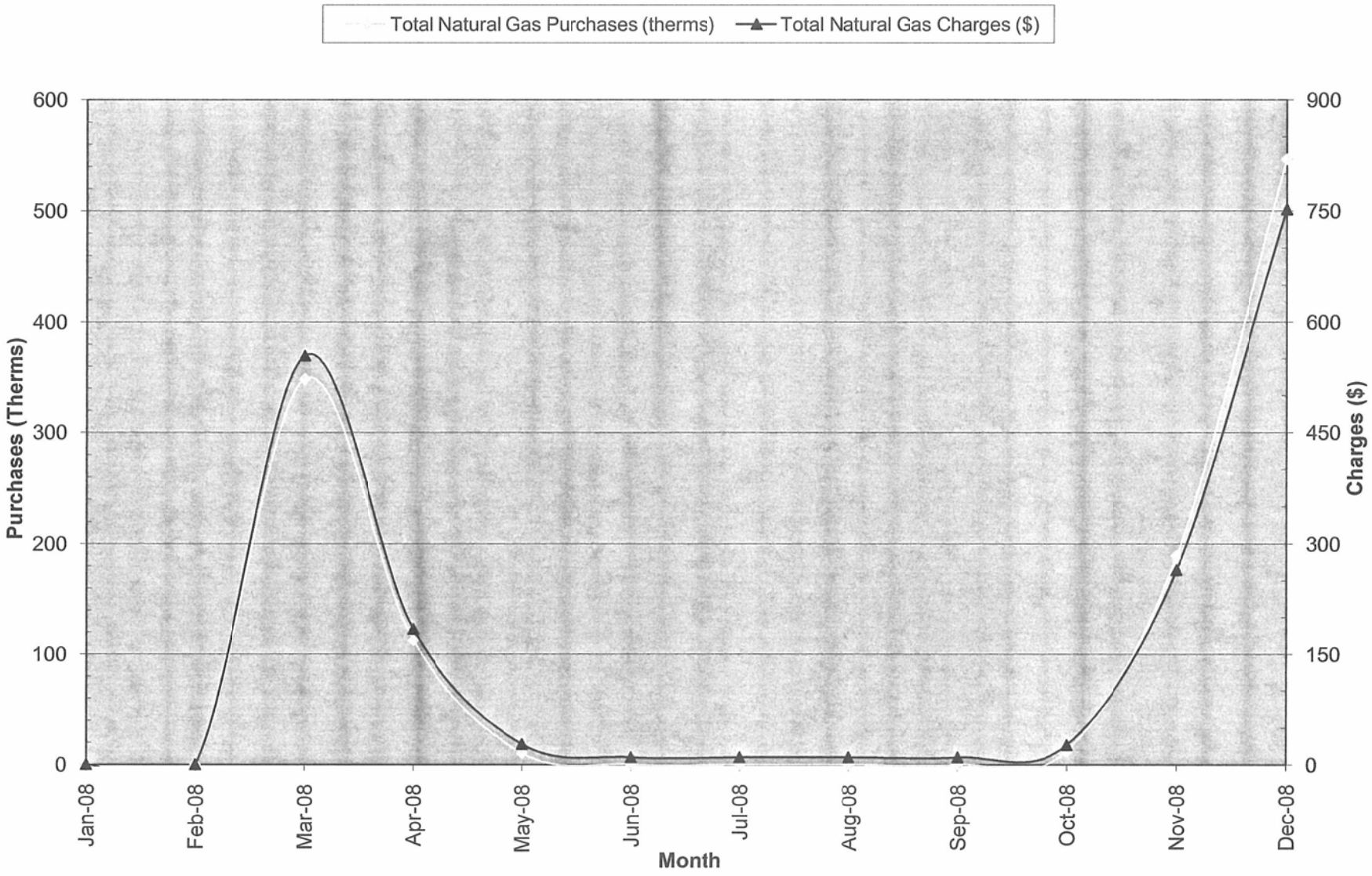
New Jersey BPU Energy Audit Program
CHA Project No.: 20711
Town of Kearny
PSE&G - Natural Gas Service

Fire Department #3 - 110 Midland Ave.
Account No.: 11 709 098 17
Meter No.: 2532916

Month	Therms	Charges ($)	($/Therm)
January-08	-	-	-
February-08	-	-	-
March-08	348	554.24	1.590
April-08	113	184.27	1.635
May-08	10	27.74	2.661
June-08	0	9.93	-
July-08	0	9.93	-
August-08	0	9.93	-
September-08	0	9.93	-
October-08	13	26.71	2.129
November-08	189	264.67	1.397
December-08	547	751.98	1.375

Most Recent Yr	1,220	1,849	1.515

Natural Gas Usage - Town of Kearny Fire Department #3



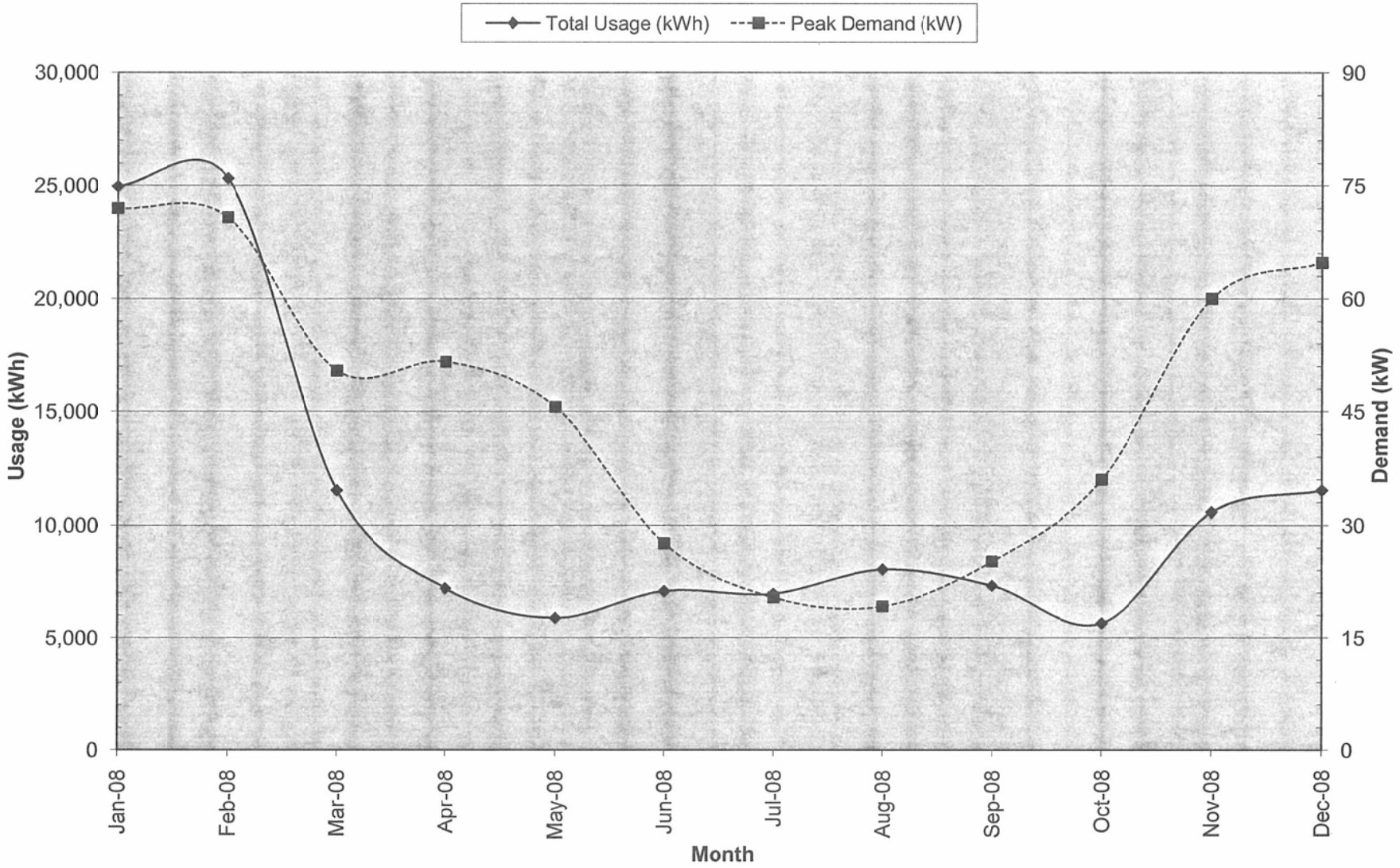
Utility Data - Kearny Fire#3(rev-0).xls
Natural Gas Chart

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

Fire Department #3 - 110 Midland Ave.
Account No.: 11 709 098 17
Meter No.: 578003115

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-08	24,960	72.0	$3,181.72	$325.45	$2,856.27	0.1275	0.1144	4.52
February-08	25,320	70.8	$3,309.93	$320.77	$2,989.16	0.1307	0.1181	4.53
March-08	11,520	50.4	$1,772.13	$239.18	$1,532.95	0.1538	0.1331	4.75
April-08	7,200	51.6	$1,330.18	$243.86	$1,086.32	0.1847	0.1509	4.73
May-08	5,880	45.6	$1,187.73	$220.49	$967.24	0.2020	0.1645	4.84
June-08	7,080	27.6	$1,648.72	$407.14	$1,241.58	0.2329	0.1754	14.75
July-08	6,960	20.4	$1,578.94	$335.87	$1,243.07	0.2269	0.1786	16.46
August-08	8,040	19.2	$1,743.94	$322.53	$1,421.41	0.2169	0.1768	16.80
September-08	7,320	25.2	$1,672.56	$389.25	$1,283.31	0.2285	0.1753	15.45
October-08	5,640	36.0	$1,240.68	$249.83	$990.85	0.2200	0.1757	6.94
November-08	10,560	60.0	$1,817.99	$343.47	$1,474.52	0.1722	0.1396	5.72
December-08	11,520	64.8	$1,921.85	$362.16	$1,559.69	0.1668	0.1354	5.59
Most Recent Yr	132,000	72.0	$22,406.37	$3,760.00	$18,646.37	0.1697	0.1413	6.92

Electric Usage - Town of Kearny Fire Department #3



Utility Data - Kearny Fire#3(rev-0).xls
Electricity 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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Apr 10, 2009

ELECTRIC MARKETERS LIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Jan 14, 2009

APPENDIX B

ECM-1 Increase Wall Insulation

Kearny NJ
CHA #20711
Building: Fire Station #3

ECM-1 Increase Wall Insulation

Install insulation for East wall in apparatus area

Total Existing Wall Area	1,560	sf
Existing U-value	0.18	Btu/hr/(sf*F)
Proposed U-value	0.05	Btu/hr/(sf*F)
Heating Efficiency	80%	
Cooling Efficiency	1.20	kW/ton

Existing Cooling

Max. North Wall Cooling Load	2,036	Btu/hr
Max. East Wall Cooling Load	8,140	Btu/hr
Max. South Wall Cooling Load	736	Btu/hr
Max. West Wall Cooling Load	235	Btu/hr

Existing Heating

Existing Heating Load Temp Diff.	50	F
Existing Max. Wall Heating Load	21,623	Btu/hr

Proposed Cooling

Max. North Wall Cooling Load	560	Btu/hr
Max. East Wall Cooling Load	2,239	Btu/hr
Max. South Wall Cooling Load	211	Btu/hr
Max. West Wall Cooling Load	65	Btu/hr

Proposed Heating

Proposed Max. Heating Load	5,946	Btu/hr

Occupied Cooling Setpoint	74	F
Unoccupied Cooling Setpoint	80	F

Occupied Heating Setpoint	64	F
Unoccupied Heating Setpoint	60	F

Existing Cooling Total	423	kWh/yr
Proposed Cooling Total	116	kWh/yr
Savings	306	kWh/yr

Existing Heating Total	33,935,956	Btu/yr
Proposed Heating Total	9,332,388	Btu/yr
Savings	24,603,568	Btu/yr
Input	308	therms

				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)
97.5	3	3	0	11,178	3,074	-	-	11,178	3,074	-	-	3	-	1	-
92.5	34	34	0	8,800	2,420	-	-	7,984	2,196	-	-	30	-	8	-
87.5	131	131	0	6,421	1,766	-	-	4,790	1,317	-	-	84	-	23	-
82.5	500	500	0	4,043	1,112	-	-	1,597	439	-	-	202	-	56	-
77.5	620	620	0	1,665	458	-	-	-	-	-	-	103	-	28	-
72.5	664	664	0	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	854	0	-	-	-	-	-	-	-	-	-	-	-	-
62.5	927	927	0	-	-	425	117	-	-	-	-	-	394,396	-	108,459
57.5	600	600	0	-	-	1,844	507	-	-	709	195	-	1,106,182	-	304,200
52.5	610	610	0	-	-	3,262	897	-	-	2,127	585	-	1,989,709	-	547,170
47.5	611	611	0	-	-	4,680	1,287	-	-	3,545	975	-	2,859,480	-	786,357
42.5	656	656	0	-	-	6,098	1,677	-	-	4,964	1,365	-	4,000,407	-	1,100,112
37.5	1,023	1,023	0	-	-	7,516	2,067	-	-	6,382	1,755	-	7,689,240	-	2,114,541
32.5	734	734	0	-	-	8,935	2,457	-	-	7,800	2,145	-	6,557,956	-	1,803,438
27.5	334	334	0	-	-	10,353	2,847	-	-	9,218	2,535	-	3,457,811	-	950,898
22.5	252	252	0	-	-	11,771	3,237	-	-	10,636	2,925	-	2,966,269	-	815,724
17.5	125	125	0	-	-	13,189	3,627	-	-	12,055	3,315	-	1,648,636	-	453,375
12.5	47	47	0	-	-	14,607	4,017	-	-	13,473	3,705	-	686,542	-	188,799
7.5	22	22	0	-	-	16,025	4,407	-	-	14,891	4,095	-	352,560	-	96,954
2.5	13	13	0	-	-	17,444	4,797	-	-	16,309	4,485	-	226,767	-	62,361
-2.5	0	0	0	-	-	18,862	5,187	-	-	17,727	4,875	-	-	-	-
-7.5	0	0	0	-	-	20,280	5,577	-	-	19,145	5,265	-	-	-	-
TOTALS	8,760	8,760	0									423	33,935,956	116	9,332,388

Kearny NJ
CHA #20711
Building: Fire Station #3

ECM-1 Increase Wall 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.		
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
Extruded Polystyrene (40 psi)	1,560	sf	$ 1.09	$ 0.44	$ 0.06	$ 1,665	$ 831	$ 94	$ 2,589	
Reinstallations/relocations	1	ls		$ 1,200		$ -	$ 1,452	$ -	$ 1,452	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$4,041	Subtotal
$1,212	30% Contingency
$788	15% Contractor O&P
$0	Engineering
$6,041	**Total**

APPENDIX C

ECM-2 Install Infrared Garage Heaters

Kearny NJ
CHA #20711
Fire Station #3

ECM-2 Install Infrared Garage Heaters

Garage Building Footprint	3,528	SF
Heat Content	100,000	Btu/Therm
Building Balance Temp.	60	°F
Internal Gains	13,500	btu/h
Unoc Internal Gain factor	0.03	
Ave Occ Internal Gain Factor	0.7	
Existing Heating Efficiency	80%	
Existing Heat Distribution Effectiveness	80%	
Proposed Burner Efficiency	85%	
Proposed Heat Distribution Effectiveness	100%	

Ex Occupied Htg Temp.	64	°F
Ex Unoccupied Htg Temp.	60	°F
Occupied Heating UA	1,024	btu/hr/°F
Unoccupied Heating UA	1,024	btu/hr/°F

Heating Energy Savings	680	Therms/yr
Electric Energy Savings	(222)	kWh/yr
Electric Demand Savings	(0.22)	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	0	0	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
97.5	43	3	3	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
92.5	40	34	34	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
87.5	37	131	131	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
82.5	34	500	500	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
77.5	32	620	620	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
72.5	29	664	664	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
67.5	27	854	854	0	0	0	-9,450	0	0	-405	0	0	-9,450	0	0	-405	0	0
62.5	25	927	927	0	1,536	1,301	-9,450	0	0	-405	1,536	1,301	-9,450	0	0	-405	0	0
57.5	21	600	600	0	6,655	5,638	-9,450	2,560	0	-405	6,655	5,638	-9,450	2,560	0	-405	27	20
52.5	19	610	610	0	11,775	9,975	-9,450	7,679	0	-405	11,775	9,975	-9,450	7,679	0	-405	117	88
47.5	16	611	611	0	16,894	14,311	-9,450	12,798	0	-405	16,894	14,311	-9,450	12,798	0	-405	208	156
42.5	14	656	656	0	22,013	18,648	-9,450	17,918	0	-405	22,013	18,648	-9,450	17,918	0	-405	320	241
37.5	13	1,023	1,023	0	27,133	22,985	-9,450	23,037	0	-405	27,133	22,985	-9,450	23,037	0	-405	650	489
32.5	11	734	734	0	32,252	27,322	-9,450	28,157	0	-405	32,252	27,322	-9,450	28,157	0	-405	575	433
27.5	9	334	334	0	37,372	31,658	-9,450	33,276	0	-405	37,372	31,658	-9,450	33,276	0	-405	311	234
22.5	7	252	252	0	42,491	35,995	-9,450	38,395	0	-405	42,491	35,995	-9,450	38,395	0	-405	272	205
17.5	6	125	125	0	47,610	40,332	-9,450	43,515	0	-405	47,610	40,332	-9,450	43,515	0	-405	153	115
12.5	4	47	47	0	52,730	44,669	-9,450	48,634	0	-405	52,730	44,669	-9,450	48,634	0	-405	65	49
7.5	3	22	22	0	57,849	49,005	-9,450	53,754	0	-405	57,849	49,005	-9,450	53,754	0	-405	33	25
2.5	1	13	13	0	62,969	53,342	-9,450	58,873	0	-405	62,969	53,342	-9,450	58,873	0	-405	22	16
-2.5	0	0	0	0	68,088	57,679	-9,450	63,992	0	-405	68,088	57,679	-9,450	63,992	0	-405	0	0
-7.5	-2	0	0	0	73,207	62,016	-9,450	69,112	0	-405	73,207	62,016	-9,450	69,112	0	-405	0	0
TOTALS		8,760	8,760	0													2,752	2,072
			5,954															

Existing Building Ventilation & Infiltration (occ)	803	cfm
Overheat Ventilation Factor	0.00	
Additional ventilation to offset overheat	0	cfm
Existing Building Ventilation & Infiltration (unocc)	0	cfm

Unit Heater Fan Savings

#	Description	Voltage	Load Factor	Existing HP	Existing Efficiency	Proposed FLA	Existing # of Units	Proposed # of Units	Existing kW	Proposed kW	Annual Hours	Existing Use kWh	Proposed Use kWh	Savings kWh
UH-1	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	992	39	0	39
UH-2	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	992	39	0	39
UH-3	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	992	39	0	39
UH-4	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	992	39	0	39
UH-5	Blower Motor	115	0.8	0.055	82.5%		1		0.04	0.00	992	39	0	39
Infrared	Blower Motor	120	0.8	0.000	82.5%	1.1		4	0.00	0.42	992	0	419	(419)
Total				0.275			5	4	0.20	0.42		197	419	(222)

Kearny NJ
CHA #20711
Fire Station #3

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	5	ea		$ 300		$ -	$ 1,815	$ -	$ 1,815	
NG Infrared Tube Heater garage area (50MBH)	4	ea	$ 450	$ 158		$ 1,764	$ 765	$ -	$ 2,529	
Miscellaneous Gas Piping, Valves, etc.	4	ls	$ 400	$ 450		$ 1,568	$ 2,178	$ -	$ 3,746	
4" Class B Vent Piping	40	lf	$ 6.70	$ 10		$ 263	$ 484	$ -	$ 747	
4" Chimney Cap	4	ea	$ 11	$ 10		$ 43	$ 48	$ -	$ 92	
T-stats (w/setback, control wiring)	2	ea	$ 95	$ 30		$ 186	$ 73	$ -	$ 259	
Electric wiring for ignition	2	ea	$ 15	$ 90		$ 29	$ 218	$ -	$ 247	

Note: Unit selections and budgetary pricing are per Reznor VR series infrared tube heaters.

$9,434	Subtotal
$1,887	20% Contingency
$1,698	15% Contractor O&P
$0	0% Engineering
$13,019	**Total**

APPENDIX D

ECM-3 Replace Domestic Hot Water Heater

Kearny NJ
CHA #20711
Building: Fire Station #3

ECM-3 Replace DHW Heater

Summary

* Replace electric hot water heater w/ tankless instantaneous high efficiency unit

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	230	kWh/month	Estimated base on rating and utilization
Electric Demand	4.5	kW	
Total Annual Utility Demand by Water Heater	9,415	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	100%		Per manufacturer nameplate
Total Annual Hot Water Demand	9,415	MBTU/yr	
Existing Tank Size	50	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	5	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)	0.6	MBH	
Annual Standby Hot Water Load	5,019	MBTU/yr	
New Tank Size	0	Gallons	Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Hot Water Piping System Capacity	5	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	456	MBTU/yr	
Total Annual Hot Water Demand	4,853	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Proposed Fuel Use	5,292	MBTU/yr	Standby Losses and inefficient DHW heater eliminated
Electricty cost	0.169	$/kWh	
Gas Cost	$1.51	$/Therm	
Existing Operating Cost of DHW	$466	$/yr	
Proposed Operating Cost of DHW	$80	$/yr	

Savings Summary:

Utility	Energy	Cost Savings
Total Operating Cost Electric (kWh)	2,759	$840
Natural Gas (therms)	(53)	($80)
Cost savings		$760

Kearny NJ
CHA #20711
Building: Fire Station #3

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		
						$ -	$ -	$ -	$ -	
Electric DHW Heater Removal	1	LS		$ 50		$ -	$ 61	$ -	$ 61	
Instantaneous Gas-Fired DHW Heater	1	EA	$ 2,500	$ 280		$ 2,450	$ 339	$ -	$ 2,789	
Miscellaneous Electrical	1	LS	$ 500			$ 490	$ -	$ -	$ 490	
Venting Kit	1	EA	$ 450	$ 650		$ 441	$ 787	$ -	$ 1,228	
Gas and water piping and connections	1	LS	$ 440	$ 360		$ 431	$ 436	$ -	$ 867	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 5,434	Subtotal	
$ 1,087	20%	Contingency
$ 978	15%	Contractor O&P
$ -	0%	Engineering
$ 7,498	**Total**	

APPENDIX E

ECM-4 Lighting Replacements

Energy Audit of Kearny, NJ
CHA Project No. 20711 - Fire Station #3
ECM-4 Lighting Replacements

0 $0.141 $/kWh
$6.92 $/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
35	Upstairs Rear Storage Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2000	360	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2,000	360	-	-	$ -	$ -	$0		
71	Upstairs Rear Stairway	2	I 60	I60/1	60	0.1	SW	2600	312	2	CF 26	CFQ26/1-L	27	0.1	SW	2,600	140	172	0.1	$ 29.68	$ 12.50	$0	0.4	0.4
80	Upstairs Rear Corridor	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	398	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2,600	398	-	-	$ -	$ -	$0		
X1	Upstairs Rear Corridor	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	4	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	4	-	-	$ -	$ -	$0		
35	Inspector's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
35	Inspector's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
80	Upstairs Middle Corridor	5	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	663	5	SP 36 R CF 1	CFT36/1	51	0.3	SW	2,600	663	-	-	$ -	$ -	$0		
X1	Upstairs Middle Corridor	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	8	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	8	-	-	$ -	$ -	$0		
35	Chief Inspector's Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2,600	936	-	-	$ -	$ -	$0		
80	Chief Inspector's Office	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	530	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2,600	530	-	-	$ -	$ -	$0		
35	Training Room	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2,600	936	-	-	$ -	$ -	$0		
80	Training Room	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2,600	265	-	-	$ -	$ -	$0		
35	Fire Chief	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2,600	936	-	-	$ -	$ -	$0		
80	Fire Chief	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	530	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2,600	530	-	-	$ -	$ -	$0		
80	Front Stairway	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	796	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2,600	796	-	-	$ -	$ -	$0		
226	Front Stairway	2	70 W MH	MH70/1	95	0.2	SW	2600	494	2	70 W MH	MH70/1	95	0.2	SW	2,600	494	-	-	$ -	$ -	$0		
35	Upstairs Front Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	C-OCC	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	C-OCC	2,080	187	-	-	$ -	$ -	$0		
35	Notary Public	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	1,170	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2,600	1,170	-	-	$ -	$ -	$0		
X1	Notary Public	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	4	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	4	-	-	$ -	$ -	$0		
80	Front Entrance	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	796	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2,600	796	-	-	$ -	$ -	$0		
X1	Front Entrance	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	4	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	4	-	-	$ -	$ -	$0		
35	Dispatch	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8,760	1,577	-	-	$ -	$ -	$0		
X1	Dispatch	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	Breaker	8,760	13	-	-	$ -	$ -	$0		
35	Dispatch Night Light	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8,760	1,577	-	-	$ -	$ -	$0		
80	Downstairs Front Corridor	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	398	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2,600	398	-	-	$ -	$ -	$0		
X1	Downstairs Front Corridor	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	4	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	4	-	-	$ -	$ -	$0		
35	Bedroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
35	Bedroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
80	Bedroom	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2,600	265	-	-	$ -	$ -	$0		
80	Bedroom	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2,600	265	-	-	$ -	$ -	$0		
18	Downstairs Bathroom	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2080	466	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2,080	466	-	-	$ -	$ -	$0		
87	Downstairs Bathroom	2	W 32 W F 2	F42LE	71	0.1	C-OCC	2080	295	2	W 32 W F 2	F42LE	71	0.1	C-OCC	2,080	295	-	-	$ -	$ -	$0		
71	Downstairs Bathroom	2	I 60	I60/1	60	0.1	C-OCC	2080	250	2	CF 26	CFQ26/1-L	27	0.1	C-OCC	2,080	112	137	0.1	$ 24.84	$ 12.50	$0	0.5	0.5
35	Conference/Kitchen Area	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2,600	936	-	-	$ -	$ -	$0		
35	Open Sleep Area	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2,600	702	-	-	$ -	$ -	$0		
35	Open Sleep Area	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2,600	936	-	-	$ -	$ -	$0		
35	Open Sleep Area	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2,600	702	-	-	$ -	$ -	$0		
80	Downstairs Middle Corridor	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2,600	265	-	-	$ -	$ -	$0		
87	Downstairs Middle Bathroom	1	W 32 W F 2	F42LE	71	0.1	SW	2080	148	1	W 32 W F 2	F42LE	71	0.1	SW	2,080	148	-	-	$ -	$ -	$0		
71	Downstairs Middle Bathroom	2	I 60	I60/1	60	0.1	SW	2080	250	2	CF 26	CFQ26/1-L	27	0.1	SW	2,080	112	137	0.1	$ 24.84	$ 12.50	$0	0.5	0.5
80	Downstairs Rear Corridor	1	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	133	1	SP 36 R CF 1	CFT36/1	51	0.1	SW	2,600	133	-	-	$ -	$ -	$0		
38	Locker Room	2	T 32 R F 2 (ELE)	F42LL	60	0.1	OCC	2600	312	2	T 32 R F 2 (ELE)	F42LL	60	0.1	OCC	2,600	312	-	-	$ -	$ -	$0		
38	Lounge	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2600	312	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2,600	312	-	-	$ -	$ -	$0		
38	Lounge	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2600	468	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
38	Lounge	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2600	312	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2,600	312	-	-	$ -	$ -	$0		
X1	Lounge	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	4	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2,600	4	-	-	$ -	$ -	$0		
199	Utility Room	2	W 32 C F 1 (ELE)	F41LL	32	0.1	SW	2600	166	2	W 32 C F 1 (ELE)	F41LL	32	0.1	SW	2,600	166	-	-	$ -	$ -	$0		
116	Garage	2	X 7.0 W 1	EI7.5/1	8	0.0	SW	8760	140	2	X 1.5C LED	ELED1.5/2	3	0.0	SW	8,760	53	88	0.0	$ 13.18	$ 237.50	$0	18.0	18.0
199	Garage	21	W 32 C F 1 (ELE)	F41LL	32	0.7	SW	8760	5,887	21	W 32 C F 1 (ELE)	F41LL	32	0.7	SW	8,760	5,887	-	-	$ -	$ -	$0		
204	Garage	1	S 96 C F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	1,813	1	S 96 C F 2 (MAG) 8'	F82EHE	207	0.2	SW	8,760	1,813	-	-	$ -	$ -	$0		
71	Front Entrance Exterior Lights	2	I 60	I60/1	60	0.1	Timer	4368	524	2	CF 26	CFQ26/1-L	27	0.1	Timer	4,368	236	288	0.1	$ 46.13	$ 12.50	$0	0.3	0.3
80	Front Entrance Exterior Lights	3	SP 36 R CF 1	CFT36/1	51	0.2	Timer	4368	668	3	SP 36 R CF 1	CFT36/1	51	0.2	Timer	4,368	668	-	-	$ -	$ -	$0		
80	Exterior Garage Lights	1	SP 36 R CF 1	CFT36/1	51	0.1	Timer	4368	223	1	SP 36 R CF 1	CFT36/1	51	0.1	Timer	4,368	223	-	-	$ -	$ -	$0		
65	Rear Exterior Entrance Lights	1	I 100	I100/1	100	0.1	Timer	4368	437	1	CF 26	CFQ26/1-L	27	0.0	Timer	4,368	118	319	0.1	$ 51.02	$ 37.50	$0	0.7	0.7
226	Rear Exterior Entrance Lights	2	70 W MH	MH70/1	95	0.2	Timer	4368	830	2	70 W MH	MH70/1	95	0.2	Timer	4,368	830	-	-	$ -	$ -	$0		
	Total	**151**				**9.3**			**32,478**	**151**			**3,258**	**9**				**31,337**	**1,141**	**0.3**	**$190**	**$325**	**$0**		
																		Demand Savings			**0.3**	**$29**			
																		kWh Savings			**1,141**	**$161**			
																		Total savings				**$190**		**1.7**	**1.7**

APPENDIX F

ECM-5 Install Occupancy Sensors

Energy Audit of Kearny, NJ
CHA Project No. 20711 - Fire Station #3
ECM-5 Install Occupancy Sensors

0 $0.141 $/kWh
$6.92 $/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
35	Upstairs Rear Storage Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2000	360.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2000	360.0	0.0	0.0	$0.00	$0.00	$0.00		
71	Upstairs Rear Stairway	2	I 60	I60/1	60	0.1	SW	2600	312.0	2	I 60	I60/1	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
80	Upstairs Rear Corridor	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	397.8	3	SP 36 R CF 1	CFT36/1	51	0.2	None	2600	397.8	0.0	0.0	$0.00	$0.00	$0.00		
X1	Upstairs Rear Corridor	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	3.9	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	3.9	0.0	0.0	$0.00	$0.00	$0.00		
35	Inspector's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Inspector's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
80	Upstairs Middle Corridor	5	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	663.0	5	SP 36 R CF 1	CFT36/1	51	0.3	None	2600	663.0	0.0	0.0	$0.00	$0.00	$0.00		
X1	Upstairs Middle Corridor	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	7.8	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	7.8	0.0	0.0	$0.00	$0.00	$0.00		
35	Chief Inspector's Office	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	C-OCC	1200	432.0	504.0	0.0	$71.06	$187.50	$70.00	2.6	1.7
80	Chief Inspector's Office	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	530.4	4	SP 36 R CF 1	CFT36/1	51	0.2	None	2600	530.4	0.0	0.0	$0.00	$0.00	$0.00		
35	Training Room	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1200	432.0	504.0	0.0	$71.06	$118.75	$40.00	1.7	1.1
80	Training Room	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265.2	2	SP 36 R CF 1	CFT36/1	51	0.1	None	2600	265.2	0.0	0.0	$0.00	$0.00	$0.00		
35	Fire Chief	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	None	2600	936.0	0.0	0.0	$0.00	$0.00	$0.00		
80	Fire Chief	4	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	530.4	4	SP 36 R CF 1	CFT36/1	51	0.2	None	2600	530.4	0.0	0.0	$0.00	$0.00	$0.00		
80	Front Stairway	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	795.6	6	SP 36 R CF 1	CFT36/1	51	0.3	None	2600	795.6	0.0	0.0	$0.00	$0.00	$0.00		
226	Front Stairway	2	70 W MH	MH70/1	95	0.2	SW	2600	494.0	2	70 W MH	MH70/1	95	0.2	None	2600	494.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Upstairs Front Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	C-OCC	2080	187.2	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2080	187.2	0.0	0.0	$0.00	$0.00	$0.00		
35	Notary Public	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	1,170.0	5	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	None	2600	1,170.0	0.0	0.0	$0.00	$0.00	$0.00		
X1	Notary Public	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	3.9	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	3.9	0.0	0.0	$0.00	$0.00	$0.00		
80	Front Entrance	6	SP 36 R CF 1	CFT36/1	51	0.3	SW	2600	795.6	6	SP 36 R CF 1	CFT36/1	51	0.3	None	2600	795.6	0.0	0.0	$0.00	$0.00	$0.00		
X1	Front Entrance	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	3.9	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	3.9	0.0	0.0	$0.00	$0.00	$0.00		
35	Dispatch	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8760	1,576.8	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	8760	1,576.8	0.0	0.0	$0.00	$0.00	$0.00		
X1	Dispatch	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		
35	Dispatch Night Light	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	8760	1,576.8	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	8760	1,576.8	0.0	0.0	$0.00	$0.00	$0.00		
80	Downstairs Front Corridor	3	SP 36 R CF 1	CFT36/1	51	0.2	SW	2600	397.8	3	SP 36 R CF 1	CFT36/1	51	0.2	None	2600	397.8	0.0	0.0	$0.00	$0.00	$0.00		
X1	Downstairs Front Corridor	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	3.9	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	3.9	0.0	0.0	$0.00	$0.00	$0.00		
35	Bedroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Bedroom	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2600	468.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
80	Bedroom	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265.2	2	SP 36 R CF 1	CFT36/1	51	0.1	None	2600	265.2	0.0	0.0	$0.00	$0.00	$0.00		
80	Bedroom	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265.2	2	SP 36 R CF 1	CFT36/1	51	0.1	None	2600	265.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Downstairs Bathroom	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2080	465.9	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2080	465.9	0.0	0.0	$0.00	$0.00	$0.00		
87	Downstairs Bathroom	2	W 32 W F 2	F42LE	71	0.1	C-OCC	2080	295.4	2	W 32 W F 2	F42LE	71	0.1	None	2080	295.4	0.0	0.0	$0.00	$0.00	$0.00		
71	Downstairs Bathroom	2	I 60	I60/1	60	0.1	C-OCC	2080	249.6	2	I 60	I60/1	60	0.1	None	2080	249.6	0.0	0.0	$0.00	$0.00	$0.00		
35	Conference/Kitchen Area	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	None	2600	936.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Open Sleep Area	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702.0	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2600	702.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Open Sleep Area	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	SW	2600	936.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	None	2600	936.0	0.0	0.0	$0.00	$0.00	$0.00		
35	Open Sleep Area	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702.0	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2600	702.0	0.0	0.0	$0.00	$0.00	$0.00		
80	Downstairs Middle Corridor	2	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	265.2	2	SP 36 R CF 1	CFT36/1	51	0.1	None	2600	265.2	0.0	0.0	$0.00	$0.00	$0.00		
87	Downstairs Middle Bathroom	1	W 32 W F 2	F42LE	71	0.1	SW	2080	147.7	1	W 32 W F 2	F42LE	71	0.1	None	2080	147.7	0.0	0.0	$0.00	$0.00	$0.00		
71	Downstairs Middle Bathroom	2	I 60	I60/1	60	0.1	SW	2080	249.6	2	I 60	I60/1	60	0.1	None	2080	249.6	0.0	0.0	$0.00	$0.00	$0.00		
80	Downstairs Rear Corridor	1	SP 36 R CF 1	CFT36/1	51	0.1	SW	2600	132.6	1	SP 36 R CF 1	CFT36/1	51	0.1	None	2600	132.6	0.0	0.0	$0.00	$0.00	$0.00		
38	Locker Room	2	T 32 R F 2 (ELE)	F42LL	60	0.1	OCC	2600	312.0	2	T 32 R F 2 (ELE)	F42LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
38	Lounge	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2600	312.0	2	T 32 R F 2 (ELE)	F42LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
38	Lounge	3	T 32 R F 2 (ELE)	F42LL	60	0.2	SW	2600	468.0	3	T 32 R F 2 (ELE)	F42LL	60	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
38	Lounge	2	T 32 R F 2 (ELE)	F42LL	60	0.1	SW	2600	312.0	2	T 32 R F 2 (ELE)	F42LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
X1	Lounge	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	2600	3.9	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	2600	3.9	0.0	0.0	$0.00	$0.00	$0.00		
199	Utility Room	2	W 32 C F 1 (ELE)	F41LL	32	0.1	SW	2600	166.4	2	W 32 C F 1 (ELE)	F41LL	32	0.1	None	2600	166.4	0.0	0.0	$0.00	$0.00	$0.00		
116	Garage	2	X 7.0 W 1	EI7.5/1	8	0.0	SW	8760	140.2	2	X 7.0 W 1	EI7.5/1	8	0.0	None	8760	140.2	0.0	0.0	$0.00	$0.00	$0.00		
199	Garage	21	W 32 C F 1 (ELE)	F41LL	32	0.7	SW	8760	5,886.7	21	W 32 C F 1 (ELE)	F41LL	32	0.7	None	8760	5,886.7	0.0	0.0	$0.00	$0.00	$0.00		
204	Garage	1	S 96 C F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	1,813.3	1	S 96 C F 2 (MAG) 8'	F82EHE	207	0.2	None	8760	1,813.3	0.0	0.0	$0.00	$0.00	$0.00		
71	Front Entrance Exterior Lights	2	I 60	I60/1	60	0.1	Timer	4368	524.2	2	I 60	I60/1	60	0.1	None	4368	524.2	0.0	0.0	$0.00	$0.00	$0.00		
80	Front Entrance Exterior Lights	3	SP 36 R CF 1	CFT36/1	51	0.2	Timer	4368	668.3	3	SP 36 R CF 1	CFT36/1	51	0.2	None	4368	668.3	0.0	0.0	$0.00	$0.00	$0.00		
80	Exterior Garage Lights	1	SP 36 R CF 1	CFT36/1	51	0.1	Timer	4368	222.8	1	SP 36 R CF 1	CFT36/1	51	0.1	None	4368	222.8	0.0	0.0	$0.00	$0.00	$0.00		
65	Rear Exterior Entrance Lights	1	I 100	I100/1	100	0.1	Timer	4368	436.8	1	I 100	I100/1	100	0.1	None	4368	436.8	0.0	0.0	$0.00	$0.00	$0.00		
226	Rear Exterior Entrance Lights	2	70 W MH	MH70/1	95	0.2	Timer	4368	829.9	2	70 W MH	MH70/1	95	0.2	None	4368	829.9	0.0	0.0	$0.00	$0.00	$0.00		
	Total	**151**				**9.3**			**32,478**	**151**				**9**			**31,470**	**1,008**	**0**	**142**	**$306**	**110**		
																		Demand Savings		**0.0**	**$0**			
																		kWh Savings		**1,008**	**$142**			
																		Total Savings			**$142**		**2.2**	**1.4**

APPENDIX G

New Jersey Pay For Performance Incentive Program

Kearny NJ
CHA #20711
Building: Fire Station #3

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)	132,000	1,220
Proposed Savings	4,690	940
Existing Total MMBtus	573	
Proposed Savings MMBtus	110	
% Reduction	19.2%	
Proposed Annual Savings	$2,700	

	≥ %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	$516	$1,034	$1,550
Incentive #3	$328	$658	$986
Totals	**$844**	**$1,692**	**$2,536**

Total Project Cost	$27,100
% Incentives of Project Cost*	9.4%
Project Cost w/ Incentives*	$24,564

Project Payback (years)	
w/o Incentives	w/ Incentives
10.0	9.1

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

APPENDIX H

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:	45.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	34.6 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	17.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	3725	632.13
2	4.05	4022	682.53
3	4.58	4880	828.14
4	4.84	4769	809.30
5	5.30	5254	891.60
6	5.33	4956	841.03
7	5.27	5005	849.35
8	5.25	4952	840.35
9	5.06	4804	815.24
10	4.46	4525	767.89
11	3.15	3229	547.96
12	2.87	3114	528.45
Year	4.46	53235	9033.98

Output Hourly Performance Data

About the Hourly Performance Data

*

Output Results as Text

Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

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.

Township of Kearny
Fire Station No. 3

Cost of Electricity $0.170 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-45kW 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
$450,000	**0.0**	**53,240**	**0**	**$9,000**	**0**	**$9,000**	**$45,000**	**$25,900**	**50.0**	**11.6**

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 I

Solar Thermal Domestic Hot Water Plant

Home

What Can I Do?

Electric Choice

Home Energy

FAQs

LEARN
Fact Sheets
Lesson Plans

PLAY
Calculators

NETWORK
Organizations
Businesses
Events Calendar

BROWSE
Resources
Solar
Wind
Biomass
Geothermal
Water

Projects

TX Energy - Past and Present

Financial Help

About Us

About SECO

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)	50	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	21.36	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	50
Energy Use			
1112		? 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
1390 BTU/hr	? Power Into Water Heater	1135 BTU/hr
Cost		
$ 1.515 /Therm	? Utility Rates	$ .1697 /kWh
$ 184.472	? Yearly Water Heating Cost	$ 494.156
How Does Solar Compare?		
? Solar Water Heater Cost: $ 27100		? Percentage Solar: 70
209.864 years for gas	? Payback Time for Solar System	78.3442 years for electric

NJBPU Energy Audits
CHA # 20711
Township of Kearny
Fire Station No. 3

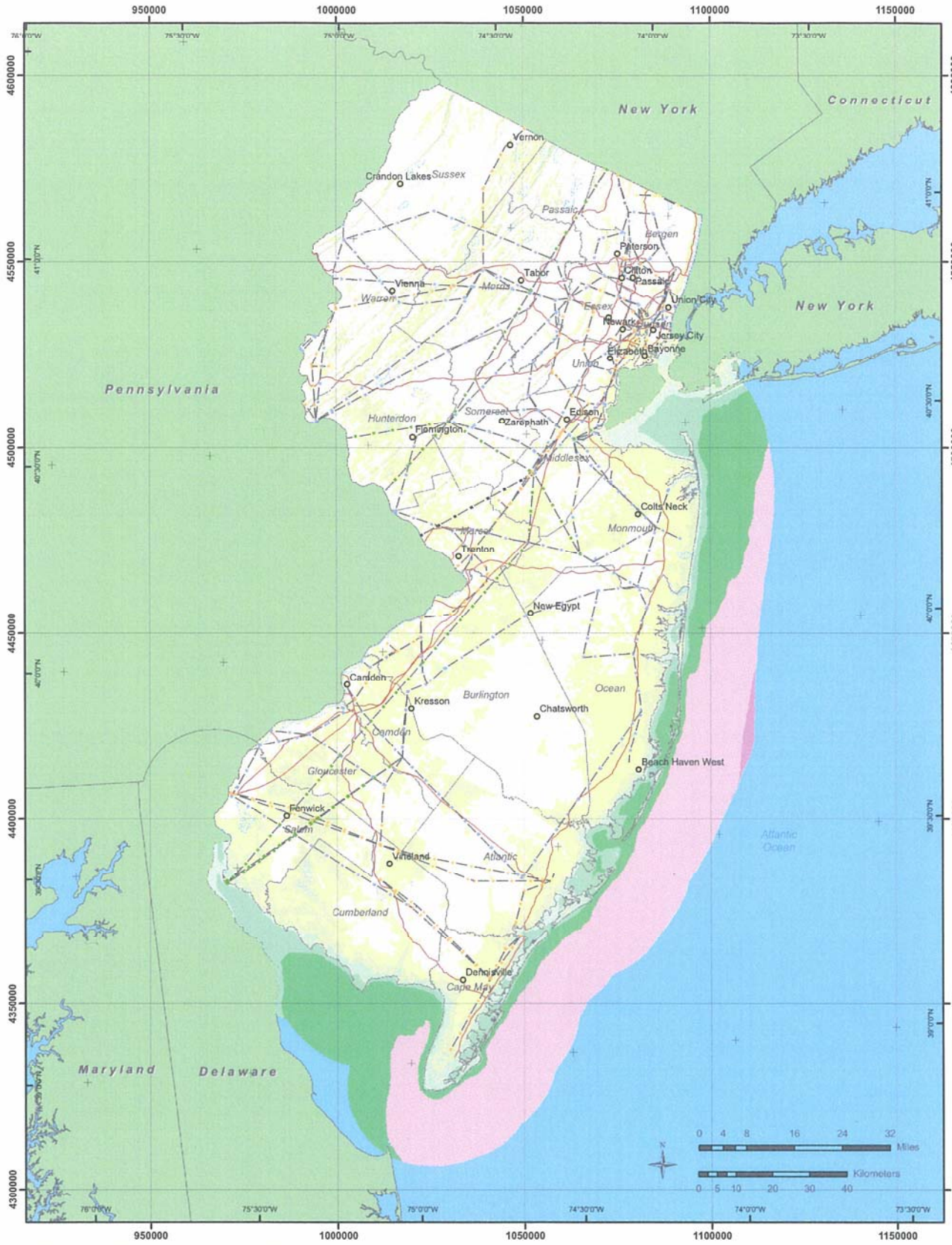
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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 J

Wind



Wind Resource of New Jersey

Mean Annual Wind Speed at 30 Meters

Features

- City
- Interstate Highway
- County Boundary
- Water Body

Generalized Transmission Line

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

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

AWS Truewind

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

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

Map of 110 Midland Ave, Kearny, NJ 07032-2717

When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

APPENDIX K

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Fire Department #3

Building ID: 2024021
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: January 28, 2010

Facility
Fire Department #3
110 Midland Avenue
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: 1974
Gross Floor Area (ft²): 4,000

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	450,384
Natural Gas (kBtu)[4]	237,000
Total Energy (kBtu)	687,384
Energy Intensity[5]	
Site (kBtu/ft²/yr)	172
Source (kBtu/ft²/yr)	438
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	81
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	179%
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 #3	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	110 Midland Avenue, 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		☐
Fire Station (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	4,000 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	168 Hours(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	15 (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 (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	11,520.00
11/01/2008	11/30/2008	10,560.00
10/01/2008	10/31/2008	5,640.00
09/01/2008	09/30/2008	7,320.00
08/01/2008	08/31/2008	8,040.00
07/01/2008	07/31/2008	6,960.00
06/01/2008	06/30/2008	7,080.00
05/01/2008	05/31/2008	5,880.00
04/01/2008	04/30/2008	7,200.00
03/01/2008	03/31/2008	11,520.00
02/01/2008	02/29/2008	25,320.00
01/01/2008	01/31/2008	24,960.00
PSE&G Electric Consumption (kWh (thousand Watt-hours))		**132,000.00**
PSE&G Electric Consumption (kBtu (thousand Btu))		**450,384.00**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**450,384.00**
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	547.00
11/01/2008	11/30/2008	189.00
10/01/2008	10/31/2008	13.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00
07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
05/01/2008	05/31/2008	10.00
04/01/2008	04/30/2008	113.00
03/01/2008	03/31/2008	348.00

02/01/2008	02/29/2008	575.00
01/01/2008	01/31/2008	575.00
PSE&G Natural Gas Consumption (therms)		**2,370.00**
PSE&G Natural Gas Consumption (kBtu (thousand Btu))		**237,000.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**237,000.00**
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 #3
110 Midland Avenue
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 #3	
Gross Floor Area Excluding Parking: (ft^2)	4,000
Year Built	1974
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Fire Station	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	4,000
Number of PCs[o]	4
Weekly operating hours[o]	168
Workers on Main Shift[o]	15

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/ft2)	172	172	0	N/A	78
Source (kBtu/ft2)	438	438	0	N/A	157
Energy Cost					
$/year	$ 24,255.70	$ 24,255.70	N/A	N/A	$ 11,009.28
$/ft2/year	$ 6.06	$ 6.06	N/A	N/A	$ 2.75
Greenhouse Gas Emissions					
$MtCO_2e$/year	81	81	0	N/A	37
$kgCO_2e/ft^2$/year	20	20	0	N/A	9

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 L

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #20711
Kearny
Fire Station No.3

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy (years)
Air handler AHU-1	Trane	YSC120E3RYA0NG0B0000100AD, Serial 905101897L	Gas heat/electric cooling	10 ton, 200 MBH input, 160 MBH output	Roof	1st floor	2009	30
Air handler AHU-2	Trane	YSC092E3RXA0KG0B0000100A0D, Serial 905101905L	Gas heat/electric cooling	7.5 ton, input 120 MBH, output 96MBH	Roof	Office second floor	2009	30
Split System	Trane	XB13, Model 4TTB3024A1000AA, Serial 8434PRB5F	Electric condensing unit	2Ton, 208/230V, 1ph, 60 Hz, 12 Amp ampacity	Roof	Dispatch	2009	30
Exhaust Fan EX-6	Cook	Model 60ACE 60 C2B, serial2149058395-00/0004901	Up right exhaust fan	HP 0.167, 100cfm, sp 0.5" RPM 1981	Roof	Bath	2009	20
Exhaust Fan EX-5	Cook	Model 60ACE 60 C2B, serial2149058395-00/00042101	Up right exhaust fan	RPM 1725, max. 1981, 200 cfm	Roof	Bath	2009	20
Exhaust Fan EX-4	Cook	Model 70ACE 70 C25, serial2149058395-00/0003501	Up right exhaust fan	HP 0.167, 200cfm, RPM 1725	Roof	Bath	2009	20
Exhaust Fan EX-3	Cook	Model 80ACE 80 C25, serial2149058395-00/000701	Up right exhaust fan	HP 0.167, 200cfm, RPM 1725	Roof	Bath	2009	20
Exhaust Fan	Pann	Model 243 BCR, Serial - not leg	Up right exhaust fan	Not available	Roof	Apparatus area	Unknown	Unknown
Exhaust Fan	Reliance	ID # P18S3029	Up right exhaust fan	5HP, 3450 RPM, 230V, 3ph, 60 Hz	Roof	Apparatus area	Unknown	Unknown
DHWH	AO Smith	EES 52 917, Serial MC00-0058616-917	Electric domestic hot water heater	Capacity 50 gal, Input 4500 watt	Back storage room	Entire building	1994	5
(4) Four Unit heaters	Renzor	N/A	Gas fired unit heater	Estimated Input 125,000 Btu/hr, Output 96,250 Btu/hr	Garage section	Garage	1996	7
(1) Unknown unit heater	Unknown	Unknown	Window AC cooling unit	Estimated Input 125,000 Btu/hr, Output 96,250 Btu/hr	Garage section	Garage	Unknown	Unknown