ROXBURY TOWNSHIP
WATER DEPARTMENT BOOSTER STATION
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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CHA PROJECT NO. 20556

May 2010

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TABLE OF CONTENTS

APPENDICES

A. Utility Usage Analysis
B. Equipment Inventory
C. ECM-1 Lighting Replacements
   ECM-2 Install Occupancy Sensors
   ECM-3 Lighting Replacements with Occupancy Sensors
D. ECM-4 Install Door Seals
E. ECM-5 50 HP Booster Motor Replacement
F. ECM-6 Electric Unit Heater Occupancy Control
G. New Jersey Pay For Performance Incentive Program
H. Photovoltaic (PV) Rooftop Solar Power Generation
I. Wind
J. EPA Portfolio Manager

1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for the Roxbury Township Water Department Booster Station (Booster Station). The single story, approximately 800 square foot building houses pumping equipment and an office.

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

2.0 EXECUTIVE SUMMARY

This report details the results of the energy audit for the Roxbury Township Water Department Booster Station (Booster Station) located in Landing, New Jersey. The building houses pumping equipment and an office. The following areas were evaluated for energy conservation measures:

- Lighting replacement with occupancy sensors
- Door seal replacement
- Booster motor replacement
- Heater occupancy control

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 $2,480 for the recommended ECMs may be realized with a payback of 3.8 years.

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

ECM-3 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,900	1.1	2,730	0	500	2.7	200	3.8	3.4

*Incentive is based on the New Jersey Smart Start Prescriptive Lighting Measures.

ECM-4 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
230	0	420	0	80	2.3	NA	2.9	NA

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

ECM-5 50-HP Booster Motor Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
5,200	2.9	6,300	0	1,100	3.3	200	4.7	4.5

* Incentive shown is per the New Jersey Smart Start Program, 2009 Premium Motors Application for one 50-Hp motors.

ECM-6 Electric Unit Heater Occupancy Control

Budgetary Cost	Annual Utility Savings					ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total					
$	kW	kWh	Therms	$			$	Years	Years
2,500	0.0	4,400	0	800	3.9		NA	3.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM. Note, a $75 incentive per thermostat is available for "Occupancy Controlled Thermostats for Hospitality/Institutional Facilities". The Booster Station facility likely does not qualify for this incentive, however BPU may consider it applicable on a case-by-case basis.

3.0 EXISTING CONDITIONS

3.1 Building General

3.1.1 Structure

The Booster Station facility was constructed in 1973, and is an approximately 800 square foot building consisting of two water pumps equipped with two 50 HP motors, and a small office area with adjoining restroom. The exterior is composed of face brick and concrete masonry unit (CMU) blocks built on a concrete foundation. The interior walls are constructed of CMU.

The windows and doors are single pane glass with wood frames. The windows, while single pane glass and original to building construction, are in acceptable condition considering the limited occupancy of the building. It was noted that one window, located behind the main equipment operation panel, was broken and incurred infiltration, cold drafts, and heat loss, and should be replaced. The building has one main entrance and no other emergency exits. The roof system is flat, ballasted, with a rubber membrane, and is in good condition.

3.1.2 Operating Hours

Since the building is primarily used to house two water pumps and associated equipment which require minimal supervision, the building is unoccupied for most of the day during the week. Based on discussions with township personnel, it is typically occupied approximately 20 hours per week.

3.2 Utility Usage

The building uses electricity, diesel fuel, well water, and is connected into the township's sewage system.

Electricity is purchased and delivered by Jersey Central Power & Light (JCP&L), and diesel fuel oil is used for the emergency generator only. For 2008, the building had an annual electricity consumption of 88,240 kWh at a cost of $16,200. Diesel usage data was not evaluated for this study since it is only used for the emergency generator.

The largest portion of energy usage is for electricity; the average blended rate was $0.183 per kWh. The electricity usage trend shows higher consumption in July and December. The building had a maximum kW demand of 62.9 kW and a minimum kW of 41 kW in 2008. The monthly average over the observed 12-month period was 47.4 kW.

Since the building is typically unoccupied, domestic water usage information was not collected, and water conservation measures not considered.

Utility data is provided in Appendix A.

3.3 HVAC Systems

3.3.1 Heating

The building does not contain a central heating system. Space heating is provided by seven electric unit heaters which distribute warm air to various parts of the building. Five of the electric unit heaters are ceiling mounted and two are wall mounted. Heat is controlled by wall mounted thermostats or unit mounted dial thermostats. It was observed that the heater located in the chemical storage room was operating while the room was unoccupied. None of the thermostats are programmable. Appendix B provides an Equipment Inventory.

3.3.2 Cooling

The building utilizes one small window air conditioning unit located in the rear office. The unit provides approximately 8,000 BTU of cooling and is controlled by an individual thermostat.

3.4 Lighting/Electrical Systems

The interior lighting within the building is comprised of mainly inefficient T-12 fluorescent light fixtures. The T-12s are original to building construction and are all 4' fixtures. Lighting is controlled by individual switches in each space. The lighting within the building remains in use with occupancy. In general, the lighting is turned on and off by the staff when the building is occupied. It is estimated that the lighting is in use approximately 20 hours per week. The single exit sign is energy efficient LED type wired individually to a breaker.

The building's exterior lighting consists of three incandescent fixtures that utilize 200 watt bulbs. The exterior lighting is controlled by a switch within the building. The building utilizes a 60-kW ONAN backup diesel fired generator located inside the building.

3.5 Plumbing Systems

Hot water is produced by one Vanguard electric hot water tank located in the bathroom. The tank has a capacity of 30 gallons and utilizes 4.5 kW of electricity when both elements are energized. The unit was installed in 1983.

The plumbing system consists of domestic water, sanitary, and vent piping. Plumbing fixtures include one toilet, one sink, and floor drains.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Lighting Replacements

A comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, and the number of fixtures, locations, and existing wattage established. Most of the lighting consists of T-12 fluorescent fixtures with magnetic ballasts, which are regarded as inefficient by today's standards. Each fixture is equipped with two 4-foot straight bulbs.

Overall energy consumption can be reduced by retrofitting approximately 12 T-12 fixtures with more efficient T-8 fluorescent lamps. Existing T-12 lamps and ballasts of each fixture can be replaced with electronic ballasts and two 4-foot, T-8 fluorescent lamps as required.

This measure will allow the facility to stock only T-8 fixtures in the future. Presently, the facility has a mixture of T-12 lamps with multiple ballast combinations. In the future, the facility should only purchase low wattage super T-8s and ballasts such as the low wattage 4-foot 28 watt units. These lamps may be directly installed into any existing 34 watt fixture when lamps fail. By installing these lamps over time, the most efficient lighting system available will be consistent throughout the facility.

The fluorescent lighting retrofits have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 39,000 kWh and $7,500.

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

ECM-1 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
1,700	1.1	2,600	0	500	3.1	200	3.4	3.0

*Incentive is based on the New Jersey Smart Start Prescriptive Lighting Measures.

This measure is recommended when combined with ECM-2; see ECM-3.

4.2 ECM-2 Install Occupancy Sensors

It is proposed that occupancy sensors be installed in selected rooms to turn off lights when the area is unoccupied. A lighting survey was conducted of all fixtures to determine the average time lights are presently on in each space. Occupancy sensors were not considered in mechanical areas due to safety concerns. Other areas were not considered due to the proposed location of occupancy sensors. If a sensor does not have a clear view of the area, it may darken even with people in the space, creating an unsafe condition.

Lighting fixtures throughout the building are manually turned on and off at switches located within the spaces. The lights are operational as needed based on occupancy of the facility. Each interior building light is operated approximately 20 hours per week.

Typical traffic patterns for each space were then taken into account to approximate the actual occupancy hours per day. Occupancy sensors were proposed only in the restroom and office space within this building. Two occupancy sensors and some standard electrical work are required for this measure.

Lighting controls have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 3,150 kWh, and $450.

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

ECM-2 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
240	0.0	210	0	30	1.0	40	8.0	6.6

*Incentive is based on the New Jersey Smart Start Prescriptive Lighting Measures.

This measure is recommended when combined with ECM-1; see ECM-3.

4.3 ECM-3 Lighting Replacements with Occupancy Sensors

This measure is a combination of ECMs 1 and 2 to allow for maximum energy and demand reduction. Due to interactive effects, the energy and cost savings for occupancy sensors and lighting upgrades are not cumulative.

The lighting retrofits and controls have an expected lifetime of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 40,950 kWh, and $7,500.

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

ECM-3 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,900	1.1	2,730	0	500	2.7	200	3.8	3.4

*Incentive is based on the New Jersey Smart Start Prescriptive Lighting Measures.

This measure is recommended.

4.4 ECM-4 Install Door Seals

The doors are original to the building's construction and the gaps around the perimeters result in air infiltration. Installing door seals will reduce infiltration and save energy. This measure determined the perimeter length and gap spacing of the two exterior doors. Infiltration reductions and associated energy savings were then calculated by using weather bin heating and cooling hour data.

Door seals have an expected life of 10 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 4,000 kWh and $1,000.

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

ECM-4 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
230	0	420	0	80	2.3	NA	2.9	NA

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

This measure is recommended.

4.5 ECM-5 50 HP Booster Motor Replacement

Of the two existing 50 HP electric motors on the water pumps, pump #2, which is an older model was inefficient. This ECM evaluated replacing the existing standard efficiency motor on Pump #2 with a premium efficiency motor. Savings were determined by comparing the energy usage of the existing pump motor to the energy usage with a premium efficiency motor. According to a vendor who originally installed the motor on Pump #1, since the field work was performed at the site, the Township has replaced the standard efficiency motor on Pump #2 with a premium efficiency unit. The ECM assesses the energy that will be saved due to the replacement.

The Pump #2 motor has run hours of approximately 2,200 per year and will have an expected lifetime of 20 years, according to NEMA and the estimated total energy savings are 126,000 kWh over the life of the project or $22,000.

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

ECM-5 50-HP Booster Motor Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
5,200	2.9	6,300	0	1,100	3.3	200	4.7	4.5

* Incentive shown is per the New Jersey Smart Start Program, 2009 Premium Motors Application for one 50-Hp motors.

This measure is recommended.

4.6 ECM-6 Electric Unit Heater Occupancy Control

Space temperature is controlled by seven electric unit heaters with nonprogrammable thermostats. Due to the low occupancy of the building, this measure proposes to equip the unit heaters with occupancy controlled thermostats. This measure calculates energy savings based on setting back the electric heaters to 55°F when the space is not occupied. When occupancy is sensed by the occupancy sensor, the thermostat goes into an occupied mode (programmed setpoint) for 30 minutes. After 30 minutes have elapsed and no occupancy is sensed, the thermostat goes into unoccupied mode (i.e. setback setpoint or off) until occupancy is sensed again.

Occupancy controlled thermostats have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 66,000 kWh and $12,000.

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

ECM-6 Electric Unit Heater Occupancy Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,500	0.0	4,400	0	800	3.9	NA	3.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM. Note, a $75 incentive per thermostat is available for "Occupancy Controlled Thermostats for Hospitality/Institutional Facilities". The Booster Station facility likely does not qualify for this incentive, however BPU may consider it applicable on a case-by-case basis.

This measure is recommended.

It should be noted that the Township of Roxbury could achieve similar energy savings without the installation of occupancy controlled thermostats. Timeclocks could achieve similar effects at lower cost.

5.0 POTENTIAL INCENTIVES

5.1 Incentives Overview

The Booster Station facility energy conservation project may be eligible for incentives by the New Jersey Office of Clean Energy. The largest incentives available will be for the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities that consume a minimum annual peak electric demand of 200 kW per month (building is eligible if the demand in any of the preceding 12 months exceeds 200kW). Facilities that meet this criterion must also achieve a minimum performance target of 15% by using an approved simulation modeling tool before and after construction. To utilize this program, a P4P Partner would need to be engaged.

Incentives for the P4P program include the following:

- Incentive #1: The P4P Program pays $0.05 per square foot to a maximum of $50,000 or 50% of building annual energy cost for the P4P Partner to develop an Energy Reduction Plan (ERP). This incentive is paid after approval of the ERP and signed Installation Agreement. Applicant must agree to commit to implementation of the ERP within 6 months or the incentive must be returned to the state.

- Incentive #2: 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: Paid after acceptance of Post-Construction Benchmarking Report showing energy savings over one year utilizing the approved simulation modeling tool and EPA Portfolio Manager. 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 deliver a total of $0.18/ kWh and $1.80/therm not to exceed 50% of total project cost. Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the minimum performance target calculated with the approved simulation modeling tool, not to exceed 50% of total project cost.

A new incentive structure has been announced for projects exceeding 20% in energy savings utilizing the required EPA portfolio manager benchmarking tool. The new incentive structure will double incentives #2 and #3 therefore producing a total of $0.36/kWh and a $3.60/ therm for those projects exceeding 20%. Incentive #1 for application preparation and energy reduction plan development has not changed however the maximum incentive has now been raised to 80% of project costs. The 200 kW/month minimum annual peak electric demand has been dropped so any structure can apply. This incentive structure will be in effect until December 31, 2010.

Incentives are also available for prescriptive measures for various types of equipment under the New Jersey SmartStart Buildings incentive program. This program provides incentives dependent upon the existing equipment type and proposed equipment retrofit measure. Prescriptive measures under this program are paid after installation and no energy savings verification will be required. 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 P4P Program, all energy savings from recommended ECMs are included in the total building energy usage and savings to be applied towards the P4P incentive, including any ECMs that may have incentives available in the SmartStart Buildings program. A project is not applicable for incentives in both programs.

5.2 Building Incentives

5.2.1 New Jersey P4P Program

The building is eligible for incentives under the New Jersey P4P Program. For the 800 square foot building, Incentive #1 corresponds to approximately $40. Since the overall energy reduction for the building is estimated to exceed the 15% minimum, the building is eligible for Incentives #2 and #3. When calculating the total Incentive #2 and #3 for the New Jersey P4P Program, all energy conservation measures are included as the amount received is based on building wide energy improvements. If all the energy conservation measures analyzed in this report are implemented, the total available incentive is up to $2,500 and would reduce payback from 3.9 to 2.9 years.

5.2.2 New Jersey SmartStart Buildings Program

The building is also eligible for incentives under the New Jersey SmartStart Buildings Program for the Lighting Replacements with Occupancy Sensors energy conservation measures (ECM-3), and Premium Motors (ECM-5) suggested in this study. The total amount of all qualified incentives is about $400.

As mentioned previously, a project cannot apply for incentives from both the P4P Program and the SmartStart Buildings Program for the same project. See Appendix G for calculations.

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 Booster Station facility has five electric resistance wall hanging unit heaters and two wall mounted unit distributing warm air throughout the facility. Cooling is provided by one 8,000 BTU window DX unit. To take advantage of a GHP system, the building would have to install a low temperature closed loop water source heat pump system to realize the benefit of the consistent temperature of the ground. This will also include the removal of the existing heating and cooling system.

This measure is not recommended due to the high cost to replace the existing systems.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The building 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 PVWAT 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 PVWAT 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 $689; 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 Booster Station facility had a maximum kW demand of 62.9 kW and a minimum kW of 41.0 kW over the previous 12 months. The monthly average over the observed 12 month period was 47.4 kW. The facility's existing load and roof area should justify the use of 2 kW of installed PV solar array; therefore, a 2 kW system size was selected for the calculations. The building's roof has only limited space which would not support a larger system. 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.

ECM – S1 Photovoltaic (PV) Rooftop Solar Power Generation – 2 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
20,000	0	2400	0	400	400	4,000	1200	>30	10.0

*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

This measure is not recommended at this time due to the long payback period; however, it could be a potentially viable renewable measure to be considered in the future if electricity rates continue to increase and if PV installation costs decline below $10 per watt.

6.2.2 Solar Thermal Domestic 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 for the site would transfer the heat from the panels to thermal storage tanks and transfer solar produced thermal energy to use for domestic hot water production.

As of the writing of this report, there are no incentives available for installation of thermal solar systems. Presently there is a federal tax credit of 30% of installation cost for the thermal applications, however the Township of Roxbury does not pay federal taxes and, therefore, would not benefit from this program.

The facility has limited occupancy and one bath room sink. Due to low hot water use this measure is not recommended.

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 are, 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 Roxbury New Jersey area, the map indicates a mean annual wind speed of below 10 miles per hour. For the building, there are site restrictions. Parking lots, radio communication towers, trees, and local residential housing would greatly affect a tower location. An aerial satellite image of the site and wind speed map is included in Appendix I.

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

6.4 Combined Heat and Power Generation (CHP)

Combined heat and power, cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a building 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 Booster Station facility 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, and thermal energy produced by the CHP plant 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 option for a CHP plant would be a reciprocating engine natural gas-fired unit. However, since the building does not have natural gas service, this option is not viable.

This measure is not recommended due to not having access to natural gas and limited use of summertime heat.

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 the site does not have room to store the waste organic materials, noise issues, and potential zoning issues.

6.6 Demand Response Curtailment

Presently, the Booster Station facility has electricity delivered and supplied by Jersey Central Power and Lighting Corporation (JCP&L). Utility curtailment is an agreement with the regional transmission organization and an approved Curtailment Service Providers (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a building utilizing an emergency generator, therefore reducing the electrical demand on the utility grid. PJM 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.

This program is to benefit the utility company during high demand periods and PJM 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 their 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 their emergency generators with notice to test the system. A minimum of 100 kW of curtailable load is required to enter the program. Discussions with the EnerNoc Corporation, an approved CSP, indicate that existing emergency generators will not pass the emissions requirements to enter the program.

Presently, the building has 60-kW of back up generation. During the observed period an average of 47.4 kW per month was needed. One of the two Booster pumps will need to run when tower filling is required, therefore the bulk of the electricity usage is needed during any request to reduce electrical load.

This is not recommended because the building load cannot be substantially reduced during a planned Demand Response Curtailment event.

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 building's energy consumption. Inputting such parameters at 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 building includes pumping equipment and an office area. Since more than 10% of the space is Other (i.e., Service), the building does not fall under the listed space description categories needed to generate a full report and provide an energy star rating. The portfolio manager did provide energy intensity ratings of a site intensity of 369 kBTU/ft^2.

The building's performance, however, can be compared to national site and source EUI averages. With a Source Energy Intensity of 369 kBTU/ft^2/year, the building is considered a high energy consumer per the Portfolio Manager. Reducing energy loss associated with lighting retrofit, occupancy sensor installation, door seals, window repair, 50-Hp booster motor replacement, and electric unit heater occupancy control will result in a more favorable score. If all the measures recommended in this report are fully implemented, it is projected that a Source Energy Usage Index of 303 kBTU/ft^2/year can be obtained.

A full EPA Energy Star Portfolio Manager Report is located in Appendix J. The user name and password was provided to Valarie Wyble, Executive Assistant, Township of Roxbury.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Roxbury Township Water Department Booster Station (Booster Station), in Landing, New Jersey identified potential ECMs for lighting replacement with occupancy sensors, door seal replacement, booster motor replacement, and heater occupancy control. Potential annual savings of $2,480 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-3 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,900	1.1	2,730	0	500	2.7	200	3.8	3.4

*Incentive is based on the New Jersey Smart Start Prescriptive Lighting Measures.

ECM-4 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
230	0	420	0	80	2.3	NA	2.9	NA

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

ECM-5 50-HP Booster Motor Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
5,200	2.9	6,300	0	1,100	3.3	200	4.7	4.5

* Incentive shown is per the New Jersey Smart Start Program, 2009 Premium Motors Application for one 50-Hp motors.

ECM-6 Electric Unit Heater Occupancy Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,500	0.0	4,400	0	800	3.9	NA	3.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM. Note, a $75 incentive per thermostat is available for "Occupancy Controlled Thermostats for Hospitality/Institutional Facilities". The Booster Station facility likely does not qualify for this incentive, however BPU may consider it applicable on a case-by-case basis.

APPENDIX A

Utility Usage Analysis

New Jersey BPU Energy Audit Program
CHA #20556
Building: Township of Roxbury Booster Station

Account Number: 10 00 00 1638 1 4
Jersey Central Power and Lighting

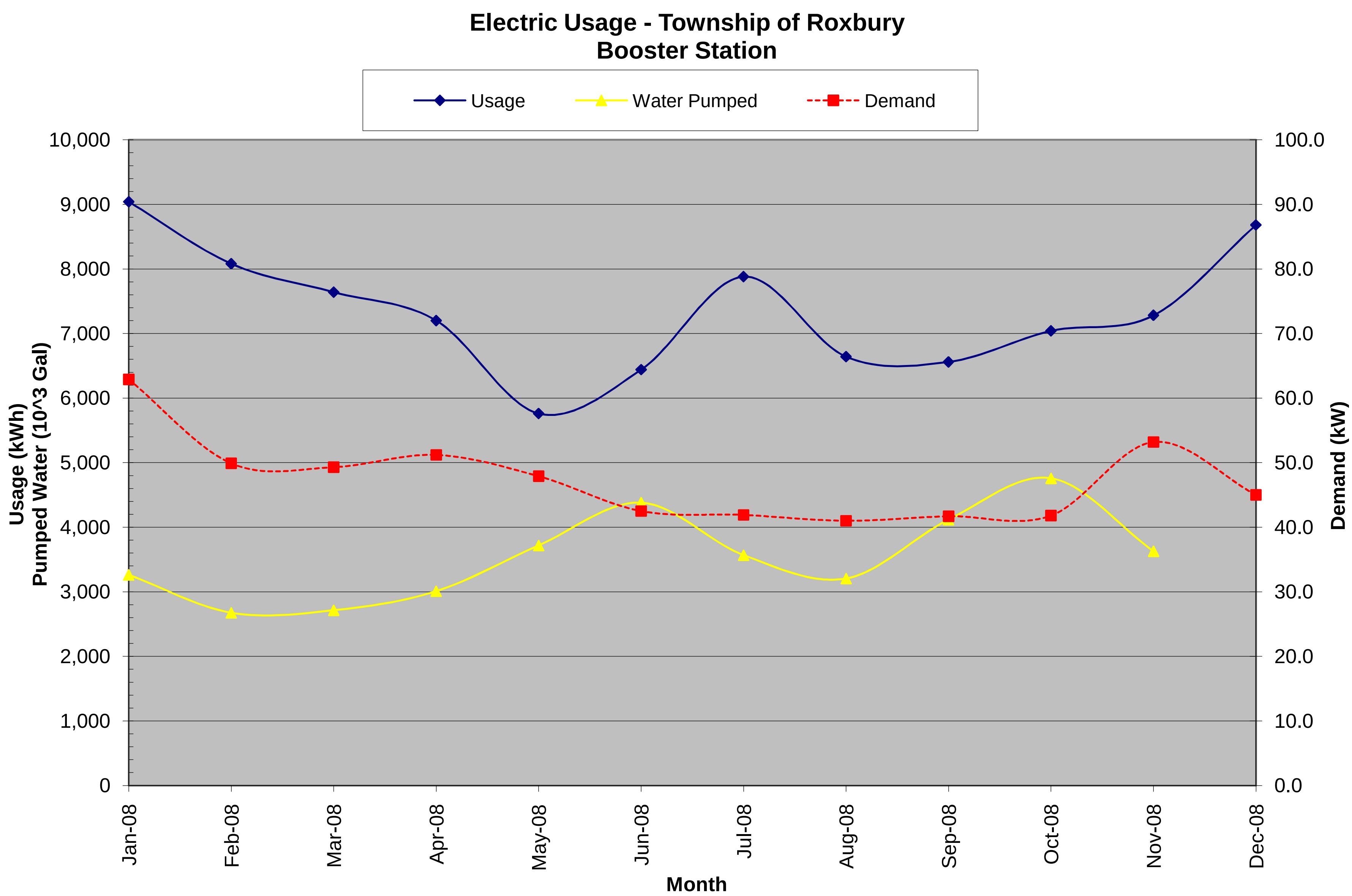
	Period	Electricity Supply kWH	Delivery KW	Cost ($)	Blended Rate ($/kWH)	Unit Cost ($/kWH)	Unit Cost ($/kW)
1	1/1/2008	9,040	62.9	1,621.26	0.1793	0.1415	5.44
2	2/1/2008	8,080	49.9	1,402.42	0.1736	0.1416	5.17
3	3/1/2008	7,640	49.3	1,327.74	0.1738	0.1405	5.16
4	4/1/2008	7,200	51.2	1,238.85	0.1721	0.1350	5.21
5	5/1/2008	5,760	47.9	1,035.86	0.1798	0.1373	5.12
6	6/1/2008	6,440	42.5	1,253.86	0.1947	0.1597	5.31
7	7/1/2008	7,880	41.9	1,551.89	0.1969	0.1688	5.28
8	8/1/2008	6,640	41.0	1,347.08	0.2029	0.1705	5.25
9	9/1/2008	6,560	41.7	1,329.10	0.2026	0.1691	5.28
10	10/1/2008	7,040	41.8	1,226.50	0.1742	0.1450	4.92
11	11/1/2008	7,280	53.2	1,336.82	0.1836	0.1452	5.25
12	12/1/2008	8,680	45.0	1,493.76	0.1721	0.1460	5.03
	Total	88,240	62.9	$ 16,165	0.1832	0.1496	5.21

Electricity Customer Charge	Energy Charge	Transmission Charge	Reconciliation Charge	Delivery Charge kWH	Delivery Charge kW	Non-Utility Gen. Chg	Societal Benefit	Transitional Assessment Charge	System Control	Outdoor Lighting	Total
$11.65	$854.04	$52.09	$31.90	$97.23	$342.26	$153.32	$51.59	$26.47	$0.71	$0.00	$1,621.26
$11.65	$763.35	$40.84	$28.51	$92.47	$258.15	$137.04	$46.11	$23.66	$0.64	$0.00	$1,402.42
$11.65	$721.78	$38.74	$14.87	$90.29	$254.27	$129.57	$43.60	$22.37	$0.60	$0.00	$1,327.74
$11.65	$680.21	$36.51	-$29.04	$88.11	$266.56	$122.11	$41.09	$21.08	$0.57	$0.00	$1,238.85
$11.65	$544.17	$29.21	-$23.24	$80.97	$245.21	$97.69	$32.87	$16.87	$0.46	$0.00	$1,035.86
$11.65	$754.08	$32.66	-$24.39	$88.97	$225.55	$109.22	$36.75	$18.86	$0.51	$0.00	$1,253.86
$11.65	$1,002.80	$39.96	-$22.32	$96.11	$221.39	$133.64	$44.97	$23.07	$0.62	$0.00	$1,551.89
$11.65	$845.00	$33.67	-$18.80	$89.96	$215.14	$112.61	$37.89	$19.44	$0.52	$0.00	$1,347.08
$11.65	$834.82	$33.27	-$28.64	$89.57	$220.00	$111.26	$37.44	$19.21	$0.52	$0.00	$1,329.10
$11.65	$765.97	$36.18	-$61.12	$87.32	$205.75	$119.40	$40.18	$20.61	$0.56	$0.00	$1,226.50
$11.65	$792.09	$38.93	-$63.20	$88.51	$279.50	$123.47	$43.97	$21.32	$0.58	$0.00	$1,336.82
$11.65	$944.41	$46.42	-$59.87	$95.45	$226.45	$147.21	$55.93	$25.42	$0.69	$0.00	$1,493.76
$139.80	$9,502.72	$458.48	-$255.34	$1,084.96	$2,960.23	$1,496.54	$512.39	$258.38	$6.98	$0.00	

Minimum Demand 41.0 kW
Average Demand 47.4 kW

Gallons of Water Pumped by Booster Station in 2008:

Period	Water Pumped 10^3 Gallons
1/1/2008	3,262
2/1/2008	2,675
3/1/2008	2,714
4/1/2008	3,009
5/1/2008	3,718
6/1/2008	4,380
7/1/2008	3,568
8/1/2008	3,206
9/1/2008	4,117
10/1/2008	4,758
11/1/2008	3,628
12/1/2008	



Utility Data - RoxburyBoosterStation(rev-1).xls
Electricity Chart

APPENDIX B

Equipment Inventory

NJBPU Energy Audits
CHA Project No. 20556
Township of Roxbury
Shore Hills Booster Pump Station #2

Equipment Inventory

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy (years)	Other Info.
Pump Motor #1	Reliance	Mod:SKS326ATE215A Ser:40112565 Eff. 94.57	Booster Pump Motor	50 Hp	Station	Main Area	2007	30	
Pump Motor #2	Reliance	Mod: P32000246 Eff. 87.5	Booster Pump Motor	50 Hp	Station	Main Area	1972	Nearing end of useful life expectancy	
Electric Unit Heater	Marley	MUH-07-8	Heater	7.5 Kw/208V	Station	Main Area	Assumed >15 years	30	ceiling mounted
Electric Unit Heater	Dayton	Ese 1850	Heater	7.5 Kw/208V	Station	Main Area	Assumed >15 years	30	ceiling mounted
Electric Unit Heater	Marley	MUH-10-8 (S/N 10-91-1995)	Heater	10 Kw/208V	Station	Main Area	1995	30	ceiling mounted
Electric Unit Heater	Marley	MUH-07-9	Heater	7.0 Kw/208V	Station	Main Area	Assumed >15 years	30	ceiling mounted
Electric Unit Heater	Dayton	2E636A	Heater	2.4 Kw/208V	Station	Cholorine Area	Assumed >15 years	30	ceiling mounted
Electric Unit Heater	Dayton	5E185d	Heater	3.0 kW	Station	Office	2007	30	wall mounted
Electric Unit Heater	N/A	N/A	Heater	3.0 kW (est)	Station	Bath Room	Assumed >15 years	30	wall mounted
Emergency Generator	ONAN	60.0DYA-15R/92670 Ser:02735888836	Stand By	60 kW	Station	Main Area	Assumed >15 years	30	
Hot Water Heater	Vangaurd	Mod:1PZ Ser:1002236443	Hot Water Heater	9.0 kW Btu 30 Gallon	Station	Bath Room	Assumed >15 years	20	
Window AC unit	Fridgidare	EAHG863IT2	AC Unit	8000 Btu	Station	Control Room	Assumed >10 years	15	
Computers (1)	Various	Various	Personal Computer	n/a	Various	Various	Various	Various	Various
Printers (1)	Various	Various	Printer	n/a	Various	Various	Various	Various	Various

APPENDIX C

ECM-1 Lighting Replacements

ECM-2 Install Occupancy Sensors

ECM-3 Lighting Replacements with Occupancy Sensors

Energy Audit of Roxbury Township
CHA Project No. 20556 - Booster Station
Existing Lighting

Cost of Electricity: **$0.150 $/kWh**
$5.21 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	Retrofit control device	(kW/space) * (Annual Hours)	Notes
2	Storage/Utility Area	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	520	None	83	area behind panel
163	Office	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	1040	OCC	391	one fixture not lit
16	Bathroom	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	520	OCC	37	
71	Chlorine Room	1	I 60	I60/1	60	0.1	SW	520	None	31	
165	Main Pump Room	5	S 40 P F 2 (MAG) WING	F42SS	94	0.5	SW	1040	None	489	
77	Main Pump Room	1	I 150	I150/1	150	0.2	SW	1040	None	156	above generator
X1	Building Entrances	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	None	13	
229	Building Exterior	3	WP200 I 1	i200/1	200	0.6	SW	4368	None	2,621	
	Total	**18**				**1.9**				**3,822**	

Energy Audit of Roxbury Township

CHA Project No. 20556 - Booster Station **Cost of Electricity:** **$0.150 $/kWh**

ECM-1 Lighting Replacements **$5.21 $/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
2	Storage/Utility Area	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	520	83	2	W 28 W F 2	F42SSILL	48	0.1	SW	520	50	33	0.1	$ 8.98	$ 256.50	$30	28.6	25.2
163	Office	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	1040	391	4	1B 28 R F 2	F42SSILL	48	0.2	SW	1,040	200	191	0.2	$ 40.13	$ 513.00	$60	12.8	11.3
16	Bathroom	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	520	37	1	T 28 R F 2	F42SSILL	48	0.0	SW	520	25	12	0.0	$ 3.37	$ 128.25	$15	38.1	33.6
71	Chlorine Room	1	I 60	I60/1	60	0.1	SW	520	31	1	CF 26	CFQ26/1-L	27	0.0	SW	520	14	17	0.0	$ 4.63	$ 6.75	$0	1.5	1.5
165	Main Pump Room	5	S 40 P F 2 (MAG) WING	F42SS	94	0.5	SW	1040	489	5	S 28 P F 2	F42SSILL	48	0.2	SW	1,040	250	239	0.2	$ 50.16	$ 641.25	$75	12.8	11.3
77	Main Pump Room	1	I 150	I150/1	150	0.2	SW	1040	156	1	CF 26	CFQ26/1-L	27	0.0	SW	1,040	28	128	0.1	$ 26.83	$ 6.75	$0	0.3	0.3
X1	Building Entrances	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	13	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8,760	13	-	-	$ -	$ -	$0		
229	Building Exterior	3	WP200 I 1	i200/1	200	0.6	SW	4368	2,621	3	WP 42 2	CF42/1-L	48	0.1	SW	4,368	629	1,992	0.5	$ 326.48	$ 121.50	$0	0.4	0.4
	Total	**18**				**1.9**			**3,822**	**18**			**296**	**1**			**1,208**	**2,613**	**1.1**	**$461**	**$1,674**	**$180**		
																	Demand Savings			**1.1**	**$70**			
																	kWh Savings			**2,613**	**$391**			
																	Total savings				**$461**		**3.6**	**3.2**

Energy Audit of Roxbury Township

CHA Project No. 20556 - Booster Station **Cost of Electricity:** **$0.150 $/kWh**

ECM-2 Install Occupancy Sensors **$5.21 $/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
2	Storage/Utility Area	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	520	83.2	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	None	520	83.2	0.0	0.0	$0.00	$0.00	$0.00		
163	Office	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	1040	391.0	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	OCC	520	195.5	195.5	0.0	$29.25	$118.75	$20.00	4.1	3.4
16	Bathroom	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	520	37.4	1	T 34 R F 2 (MAG)	F42EE	72	0.1	OCC	260	18.7	18.7	0.0	$2.80	$118.75	$20.00	42.4	35.3
71	Chlorine Room	1	I 60	I60/1	60	0.1	SW	520	31.2	1	I 60	I60/1	60	0.1	None	520	31.2	0.0	0.0	$0.00	$0.00	$0.00		
165	Main Pump Room	5	S 40 P F 2 (MAG) WING	F42SS	94	0.5	SW	1040	488.8	5	S 40 P F 2 (MAG) WING	F42SS	94	0.5	None	1040	488.8	0.0	0.0	$0.00	$0.00	$0.00		
77	Main Pump Room	1	I 150	I150/1	150	0.2	SW	1040	156.0	1	I 150	I150/1	150	0.2	None	1040	156.0	0.0	0.0	$0.00	$0.00	$0.00		
X1	Building Entrances	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	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		
229	Building Exterior	3	WP200 I 1	i200/1	200	0.6	SW	4368	2,620.8	3	WP200 I 1	i200/1	200	0.6	None	4368	2,620.8	0.0	0.0	$0.00	$0.00	$0.00		
	Total	**18**				**1.9**			**3,822**	**18**				**2**			**3,607**	**214**	**0**	**32**	**$238**	**40**		
																	Demand Savings			**0.0**	**$0**			
																	kWh Savings			**214**	**$32**			
																	Total Savings				**$32**		**7.4**	**6.2**

Energy Audit of Roxbury Township

CHA Project No. 20556 - Booster Station **Cost of Electricity:** **$0.150 $/kWh**

ECM-3 Lighting Replacements Occupancy Sensors **$5.21 $/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
2	Storage/Utility Area	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	520	83	2	W 28 W F 2	F42SSILL	48	0.1	None	520	50	33	0.1	$ 8.98	$ 256.50	$ 30	28.6	25.2
163	Office	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	1040	391	4	1B 28 R F 2	F42SSILL	48	0.2	OCC	520	100	291	0.2	$ 55.07	$ 631.75	$ 80	11.5	10.0
16	Bathroom	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	520	37	1	T 28 R F 2	F42SSILL	48	0.0	OCC	260	12	25	0.0	$ 5.23	$ 247.00	$ 35	47.2	40.5
71	Chlorine Room	1	I 60	I60/1	60	0.1	SW	520	31	1	CF 26	CFQ26/1-L	27	0.0	None	520	14	17	0.0	$ 4.63	$ 6.75	$ -	1.5	1.5
165	Main Pump Room	5	S 40 P F 2 (MAG) WING	F42SS	94	0.5	SW	1040	489	5	S 28 P F 2	F42SSILL	48	0.2	None	1,040	250	239	0.2	$ 50.16	$ 641.25	$ 75	12.8	11.3
77	Main Pump Room	1	I 150	I150/1	150	0.2	SW	1040	156	1	CF 26	CFQ26/1-L	27	0.0	None	1,040	28	128	0.1	$ 26.83	$ 6.75	$ -	0.3	0.3
X1	Building Entrances	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	13	1	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	13	-	-	$ -	$ -	$ -		
229	Building Exterior	3	WP200 I 1	i200/1	200	0.6	SW	4368	2,621	3	WP 42 2	CF42/1-L	48	0.1	None	4,368	629	1,992	0.5	$ 326.48	$ 121.50	$ -	0.4	0.4
	Total	**18**				**1.9**			**3,822**	**18**				**0.8**			**1,096**		**1.1**	**477**	**1,912**	**220**		
																	Demand Savings			**1.1**	**$70**			
																	kWh Savings			**2,726**	**$408**			
																	Total Savings				**$477**		**4.0**	**3.5**

Energy Audit of Roxbury Township
CHA Project No. 20556 - Booster Station
ECM-1 - Fixture and Control Replacement Cost Lighting Analysis

COST TABLE

Notes	Field Code	Standard Code	NYSERDA Code	Watts per fixture	Retrofit	Standard Code	NYSERDA Code	Watts per fixture	Lamps/Fix	Ball/Fix	Fixture Replacement			Ballast Replacement			Lamp Replacement			O.P.& D	NJ Incentive	Retrofit Cost (inc. O&P)
											Material	Labor	Disposal	Material	Labor	Disposal	Material	Labor	Disposal			
	X1	X 1.5 W LED	ELED1.5/1	1.5	NONE															$0.00		**$0.00**
	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	RL/RB	W 28 W F 2	F42SSILL	48	2	1				$30.00	$45.00	INC	$10.00	$10.00	INC	$33.25	**$15.00**	**$128.25**
	16	T 34 R F 2 (MAG)	F42EE	72	RL/RB	T 28 R F 2	F42SSILL	48	2	1				$30.00	$45.00	INC	$10.00	$10.00	INC	$33.25	**$15.00**	**$128.25**
	71	I 60	I60/1	60	Replace	CF 26	CFQ26/1-L	27	1								$5.00	INC	INC	$1.75	**$0.00**	**$6.75**
	77	I 150	I150/1	150	Replace	CF 26	CFQ26/1-L	27	1								$5.00	INC	INC	$1.75	**$0.00**	**$6.75**
	163	1B 40 R F 2 (MAG)	F42SS	94	RL/RB	1B 28 R F 2	F42SSILL	48	2	1				$30.00	$45.00	INC	$10.00	$10.00	INC	$33.25	**$15.00**	**$128.25**
	165	S 40 P F 2 (MAG) WING	F42SS	94	RL/RB	S 28 P F 2	F42SSILL	48	2	1				$30.00	$45.00	INC	$10.00	$10.00	INC	$33.25	**$15.00**	**$128.25**
	229	WP200 I 1	i200/1	200	Replace	WP 42 2	CF42/1-L	48	1								$60.00	$30.00	INC	$10.50	**$0.00**	**$40.50**
	OCC	OCCUPANCY SENSOR SWITCH									$50	$45	INC							$23.75	**$20.00**	**$118.75**

New Jersey Smart Start Prescriptive Lighting type	Watt/Fix	Lamps	$/Unit	
New Hard Wired Compact Fluorescents	N/A	1	$25	
New Hard Wired Compact Fluorescents	N/A	2	$30	
For retrofit of T-12 fixtures to T-5 or T-8 with electronic ballasts				
Retrofit T-12 to T-5,T-8 with Electronic Ballasts	N/A	1&2	$15	
Retrofit T-12 to T-5,T-8 with Electronic Ballasts	N/A	3 & 4	$15	
For replacement of fixtures with new T-5 or T-8 fixtures				
HID, T-12, Incandescent to T-8, T-5 with Electronic Ballasts	>1000	N/A	$284	
HID, T-12, Incandescent to T-8, T-5 with Electronic Ballasts	400-999	N/A	$100	
HID, T-12, Incandescent to T-8, T-5 with Electronic Ballasts	250--399	N/A	$50	
HID Only to T-8, T-5 with Electronic Ballasts	175-249	N/A	$43	
HID Only to T-8, T-5 with Electronic Ballasts	100-174	N/A	$30	
HID Only to T-8, T-5 with Electronic Ballasts	75-99		$16	
T-12 Only to T-8, T-5 with Electronic Ballasts (1&2 lamp)	<250	1&2	$25	
T-12 Only to T-8, T-5 with Electronic Ballasts (3&4 lamp)	<250	3 & 4	$30	
For retrofit of T-8 fixtures by permanent delamping & new reflectors	N/A	N/A	$20	
New construction and complete renovation	N/A	N/A	Perf based only	
LED Exit Signs (new fixtures only): For existing facilities with load <= 75 kW	N/A	N/A	$20	
LED Exit Signs (new fixtures only): For existing facilities with load >= 75 kW	N/A	N/A	$10	
Pulse Start Metal Halide (for fixtures >= 150 watts) - includes parking lot lighting	N/A	N/A	$25	
Parking lot low bay - LED	N/A	N/A	$43	
T-12 to T-8 fixtures by permanent delamping & new reflectors	N/A	N/A	$30	
Induction Lighting Fixtures - Retrofit of HID	>100	N/A	$60	
Induction Lighting Fixtures Replacement of HID	>100	N/A	$70	
Controls				
OSW- Occupancy Sensor Wall Mounted (existing facilities only)	N/A	N/A	$20	
OSR- Occupancy Sensor Remote Mounted (existing facilities only)	N/A	N/A	$35	
DLD-Fluorescent Daylight Dimming	N/A	N/A	$25	Per Fixture Controlled
OHLF-Occupancy controlled High-Low with Step Ballast	N/A	N/A	$25	Per Fixture Controlled
OSRH- Occupancy Sensor Remote Mounted	N/A	N/A	$35	
OHLH-Occupancy controlled High-Low with Step Ballast	N/A	N/A	$75	Per Fixture Controlled
DDH-Daylight Dimming	N/A	N/A	$75	Per Fixture Controlled

Energy Audit of Roxbury Township
CHA Project No. 20556 - Booster Station
ECM 1 - Fixture and Control Replacement Cost Lighting Analysis

Hours of Operation

Energy Audit of Roxbury Township	Hours/Day	Hours/Year	Proposed	Utilized
Exits	24	8760	8760	Y
Offices	4	1040	520	Y
Outdoor Lighting	12	4368	4368	Y
Storage Areas	2	520	520	Y
Bath Room	2	520	260	Y
Pump Room	4	1040	1040	Y

APPENDIX D

ECM-4 Install Door Seals

NJBPU Energy Audits
CHA Project No. 20556
Building: Shore Hills Booster Pump Station #2

ECM - 4 Install Door Seals

Existing: Lack of door seals result in excessive heat loss and infiltration
Proposed: Install door seals and/or weather-stripping to reduce air infiltration

Heating System Efficiency	100%		Ex Occupied Clng Temp.	N/A	*F	Ex Occupied Htg Temp.	60	*F
Cooling System Efficiency	1.20	kW/ton	Ex Unoccupied Clng Temp.	N/A	*F	Ex Unoccupied Htg Temp.	60	*F
			Prop Occupied Clng Temp.	N/A	*F	Prop Occupied Htg Temp.	60	*F
Linear Feet of Door Edge	45		Prop Unoccupied Clng Temp.	N/A	*F	Prop Unoccupied Htg Temp.	60	*F
Existing Infiltration Factor*	0.5	cfm/LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.18	$/kWh
Proposed Infiltration Factor*	0.2	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ -	$/therm

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design
based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					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	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	49.1	0	0	0	0	0	0	0	0	0	0	0
97.5	42.5	3	1	2	0	0	0	0	0	0	0	0
92.5	39.5	34	16	18	0	0	0	0	0	0	0	0
87.5	36.6	131	62	69	0	0	0	0	0	0	0	0
82.5	34.0	500	238	262	0	0	0	0	0	0	0	0
77.5	31.6	620	295	325	0	0	0	0	0	0	0	0
72.5	29.2	664	316	348	0	0	0	0	0	0	0	0
67.5	27.0	854	407	447	0	0	0	0	0	0	0	0
62.5	24.5	927	441	486	0	0	0	0	0	0	0	0
57.5	21.4	600	286	314	61	61	24	24	0	0	0	0
52.5	18.7	610	290	320	182	182	73	73	0	0	1	0
47.5	16.2	611	291	320	304	304	122	122	0	0	2	1
42.5	14.4	656	312	344	425	425	170	170	0	0	3	1
37.5	12.6	1,023	487	536	547	547	219	219	0	0	6	2
32.5	10.7	734	350	384	668	668	267	267	0	0	5	2
27.5	8.6	334	159	175	790	790	316	316	0	0	3	1
22.5	6.8	252	120	132	911	911	365	365	0	0	2	1
17.5	5.5	125	60	65	1,033	1,033	413	413	0	0	1	1
12.5	4.1	47	22	25	1,154	1,154	462	462	0	0	1	0
7.5	2.6	22	10	12	1,276	1,276	510	510	0	0	0	0
2.5	1.0	13	6	7	1,397	1,397	559	559	0	0	0	0
-2.5	0.0	0	0	0	1,519	1,519	608	608	0	0	0	0
-7.5	-1.5	0	0	0	1,640	1,640	656	656	0	0	0	0
TOTALS		**8,760**	**4,171**	**4,589**					**0**	**0**	**24**	**10**

Existing Door Infiltration	23	cfm
Existing Unoccupied Door Infiltration	23	cfm
Proposed Door Infiltration	9	cfm
Proposed Unoccupied Door Infiltration	9	cfm

Savings	**14**	**therms**	**$**	**-**
	419	**kWh**	**$**	**77**
	0	**kWh**	**$**	**-**
	419	**kWh**	**$**	**77**

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
Main Door	4	7.5	23	0.25	all sides	23	100%	0.25
Chlorine Rm. Door	3.5	7.5	22	0.25	all sides	22	100%	0.25
Total	**7.5**	**15**	**45**	**0.250**		**45**	**100%**	**0.250**

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

NJBPU Energy Audits

CHA Project No. 20556

Building: Shore Hills Booster Pump Station #2

ECM - 4 Install Door Seals

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Seals (3'x7')	2	ea	$ 35	$ 50	$ -	$ 69	$ 122	$ -	$ 191	
Door Seals (double door - 6' x 7')	0	ea	$ 65	$ 100	$ -	$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 191	Subtotal
$ 19	10% Contingency
$ 21	10% Contractor O&P
$ -	0% Engineering
$ 231	**Total**

APPENDIX E

ECM-5 50 HP Booster Motor Replacement

NJBPU Energy Audits
CHA Project No. 20556
Building: Shore Hills Booster Pump Station #2

ECM - 5 **50 Hp Booster Motor Replacement**

Demand Cost	Energy Cost
$/kW-month	$/kWh
$ 5.21	$ 0.15

Multipliers		
Material	Labor	Equipment
0.99	1.22	1.09

Savings Analysis

#	Description	Location	Existing HP	Load Factor	Existing Efficiency	Existing kW	New HP_b	New Load Factor	New Efficiency	New kW	Demand Savings	Demand Savings $	Annual Hours	kWh Savings	$ kWh Savings	Total $ Savings	Estimated Cost	Payback Years
1	Pump #2	Station	50	0.9	0.875	38.4	50	0.9	0.946	35.5	2.878	$ 180	2,200	6,332	$ 948	$ 1,128	$ 5,190	4.6
		Total	**50**			**38.4**	**50**			**35.5**	**2.88**	**$ 180**		**6,332**	**$ 948**	**$ 1,128**	**$ 5,190**	
										2.9								

Cost Estimates

#	Unit Costs Materials	Unit Costs Labor	Unit Costs Equipment	Subtotal Costs Materials	Subtotal Costs Labor	Subtotal Costs Equipment	Total Cost	Nj Incentive
1	$ 2,771	$ 600	$ -	$ 2,743	$ 732	$ -	$ 3,475	$ 198
Total								

Notes
a Price quote by Pegasus Electric, 908-852-3750 $5,190 Price will be honored Unitil March 2010

b Existing and new efficiencies should be entered if known. If not known,
use provided curve fit based on "DOE Survey Installed Average" and NEMA Premium
values, respectively.

c Same as existing HP unless resized to better match load

APPENDIX F

ECM-6 Electric Unit Heater Occupancy Control

NJBPU Energy Audits
CHA Project No. 20556
Building: Shore Hills Booster Pump Station #2

ECM - 6 **Electric Unit Heater Occupancy Control**

Description Contol electric unit heaters with occupancy sening thermoststs

Given

Electric Energy Costs	0.183	$/kWh
Gas Energy Costs	0	$/mcf
Operating Weeks per Year	25	
Cooling Season	N/A	wks
Heating Season	25	wks
Summer Indoor Setpoint Temp	N/A	degF
Winter Indoor Setpoint	65	degF
Total Fan System Load	1.5	HP

Assumptions

Reduction in Runtime Hours	60	hrs/wk
Chiller Efficiency	N/A	kW/ton
Heating Plant Efficiency	100%	
Summer Unocc. Temp	N/A	degF
Winter Unocc. Temp	55	degF
Heating Value of Fuel	N/A	Btu/mcf
CFM per motor HP	1000	cfm/hp
Cycling Factor for off hours runtime	50%	

Formula

Motor Energy Savings = (HP x 0.746 x reduced hours x operating weeksx)(1-Cf)

Cooling Energy Savings = (Fhp x (cfm/hp) x 1.08 x Td x Hr x W x Ceff)/12,000
where, Fhp = Fan HP; cfm/hp = 1000; Td = (Avg Summer Unocc Temp - Summer Indoor Setpoint);
Hr = Reduction in Clg. Operating hours; W = Cooling Season; Ceff = chiller efficiency

Heating Energy Savings = ((Fhp x (cfm/hp) x 1.08 x Td x Hr x W)/(HBtu x Heff))(1-Cf)
where, HBtu - Heating value of fuel; Heff - heating system efficiency; W - Winter Season;
Td - (Winter Indoor Setpoint - Avg Unocc Winter Temp)

Calculation

	HP	Conv.	Reduced Hrs	Weeks		CyclingFactor		
Motor Saving =(	1.5 x	0.746 x	60 x	25)x(	1 -	50%)=	**839**	Kwh

	HP	CFM/HP	Conv.	Td		Reduced Hrs	Clg Wks		Ceff					
Clg. Savings =(	1.5 x	1000 x	1.08 x	N/A	x	60 x	N/A	x	N/A	)/	12,000	=	**0**	Kwh

	HP	CFM/HP	Conv.	Td	Reduced Hrs	Htg Wks	btu/kWh	Heff		Cycling Factor		
Htg. Savings =(	1.5 x	1000 x	1.08 x	10 x	60 x	25)/(	3412 x	100%)x(	1 -	50%)=	**3,561**	**kWh**

Result

Annual Motor Savings=	**839**	**kWh**
Annual Cooling Savings=	**0**	**kWh**
Annual Heating Savings=	**3,561**	**kWh**
Total kWh Savings	**4,400**	**kWh**
Annual Cost Savings=	**$805**	

Comments

NJBPU Energy Audits
CHA Project No. 20556
Shore Hills Booster Pump Station #2

ECM - 6 Electric Unit Heater Occupancy Control

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS MAT.	LABOR	EQUIP.	SUBTOTAL COSTS MAT.	LABOR	EQUIP.	TOTAL COST	REMARKS
Unit Heater Occupancy Sensing Thermostat Controler	7	ea	223	$ 90		1545.39	$ 769	0	$ 1,937	Means Mechanical Cost Data - 2009

$ 1,937	Subtotal
$ 193.70	10% Contingency
$ 319.61	15% Contractor O&P
$ -	0% Engineering
$ 2,450	**Total**

APPENDIX G

New Jersey Pay For Performance Incentive Program

NJBPU Energy Audits
CHA Project No. 20556
Shore Hills Booster Pump Station #2

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per September, 2009.
The values represented below are only applicable through December 31, 2010.

	Annual Utilities	
	kWh	Therms
Existing Usage	88,240	0
Proposed Savings	13,877	0
Existing Total MMBtus	301	
Proposed Savings MMBtus	47	
% Reduction	15.7%	
Proposed Annual Savings	$2,487	

0.5 * Maximum allowable incentiv

	≥ %15 - < 20%	
	$/kWh	$/therm
Incentive #2	$0.11	$1.10
Incentive #3	$0.07	$0.70
	$0.18	$1.80

0.8 * Maximum allowable incentiv

	≥ 20%	
	$/kWh	$/therm
Incentive #2	$0.22	$2.20
Incentive #3	$0.14	$1.40
	$0.36	$3.60

	Incentives $		
	Elec	Gas	Total
Incentive #2	$1,527	$0	$1,527
Incentive #3	$971	$0	$971
Totals	**$2,498**	**$0**	**$2,498**

Total Project Cost	$9,783
% Incentives of Project Cost*	25.5%
Project Cost w/ Incentives*	$7,285

Project Payback (years)	
w/o Incentives	w/ Incentives
3.9	2.9

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

EPA Portfolio Manager:

	kWh	Therms
Proposed Savings	13,877	0
Proposed Savings MMBtus	47	
% Reduction	15.7%	

* Includes savings for lighting measures with prescriptive incentives.

APPENDIX H

Photovoltaic (PV) Rooftop Solar Power Generation

AC Energy & Cost Savings

* * *

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	2.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	1.5 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	18.0 ¢/kWh

Results

Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	166	29.88
2	4.05	179	32.22
3	4.58	217	39.06
4	4.84	212	38.16
5	5.30	234	42.12
6	5.33	220	39.60
7	5.27	222	39.96
8	5.25	220	39.60
9	5.06	214	38.52
10	4.46	201	36.18
11	3.15	144	25.92
12	2.87	138	24.84
Year	4.46	2366	425.88

[redacted] * [redacted]

About the Hourly Performance Data   Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

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

Cautions for Interpreting the Results

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

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

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

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

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

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

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

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

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


2 Ford Rd, Landing, NJ 07850
© 2010 Google
©2009 Google
Imagery Date: Jul 5, 2007
40°54'14.63" N 74°39'40.96" W elev 933 ft
Eye alt 1166 ft

Roxbury Shore Hills Booster Pump Station #2

Cost of Electricity $0.18 $/kWh

ECM-S-1 Photovoltaic (PV) Rooftop Solar Power Generation-2kW System

Budgetary	Annual Utility Savings				Estimated	Total	New Jersey Renewable	New Jersey Renewable	Payback	Payback
Cost					Maintenance	Savings	* Energy Incentive	** SREC	(without incentive)	(with incentive)
					Savings					
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$20,000	**0.0**	**2,366**	**0**	**$426**	**0**	**$426**	**$4,000**	**$1,151**	**47.0**	**10.1**

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

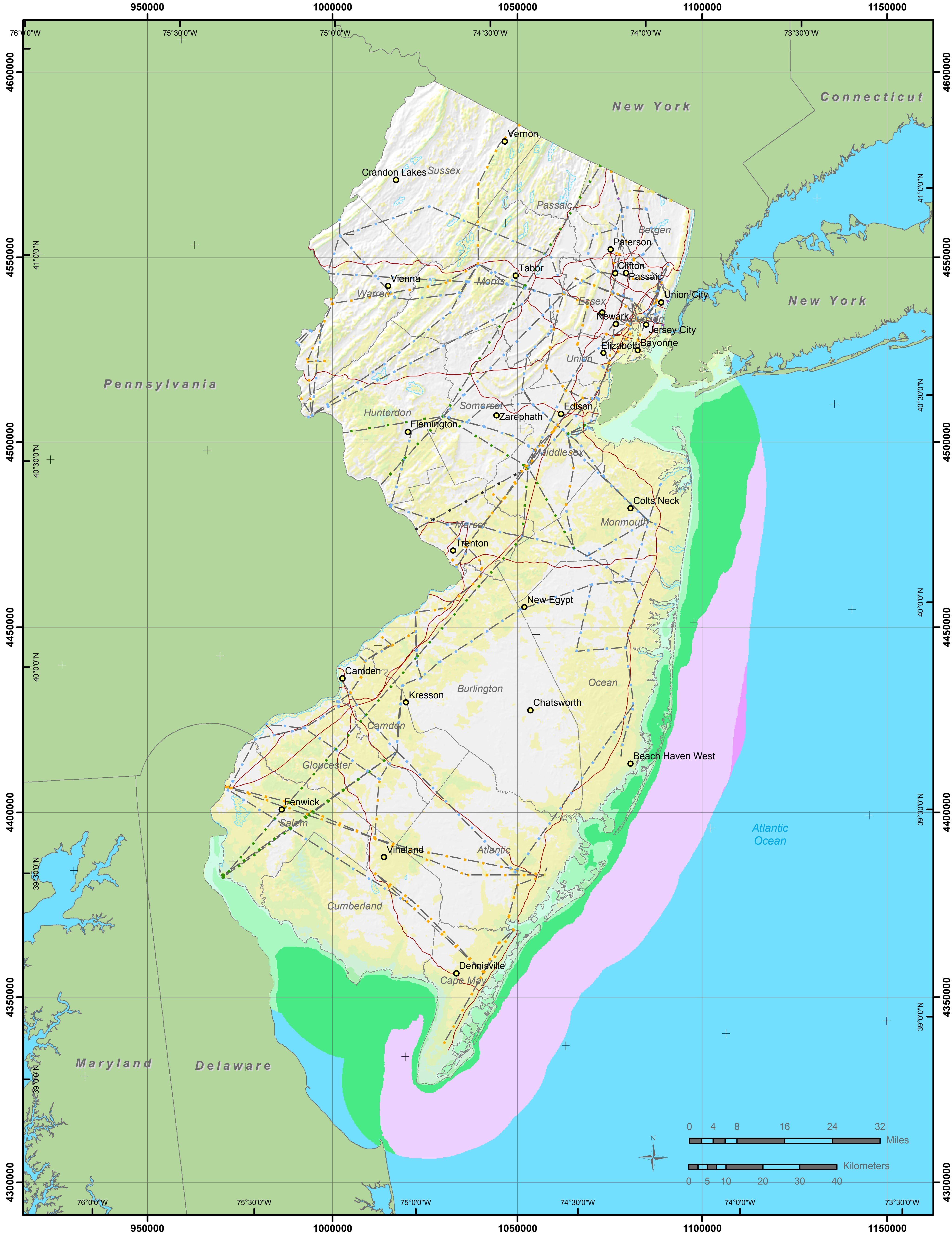
** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

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

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

Mean Speed at 30 m

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

AWS Truewind

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

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

APPENDIX J

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Booster Station

Building ID: 1933005
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 22, 2010

Facility
Booster Station
2 Ford Road
Landing, NJ 07850

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1980
Gross Floor Area (ft^2): 816

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	301,075
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	301,075

Energy Intensity[5]	
Site (kBtu/ft^2/yr)	369
Source (kBtu/ft^2/yr)	1232

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	46

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	722%
Building Type	Service (Vehicle Repair/Service, Postal Service)

Stamp of Certifying Professional

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

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

Certifying Professional
N/A

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

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	Booster Station	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Service (Vehicle Repair/Service, Postal Service)	Is this an accurate description of the space in question?		☐
Location	2 Ford Road, Landing, NJ 07850	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		☐

Entire Building (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	816 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	0(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40Hours(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	3(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist
for Commercial Buildings

Energy Consumption

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

Fuel Type: Electricity		
Meter: Electrical Meter Act #100000163814 (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	8,680.00
11/01/2008	11/30/2008	7,280.00
10/01/2008	10/31/2008	7,040.00
09/01/2008	09/30/2008	6,560.00
08/01/2008	08/31/2008	6,640.00
07/01/2008	07/31/2008	7,880.00
06/01/2008	06/30/2008	6,440.00
05/01/2008	05/31/2008	5,760.00
04/01/2008	04/30/2008	7,200.00
03/01/2008	03/31/2008	7,640.00
02/01/2008	02/29/2008	8,080.00
01/01/2008	01/31/2008	9,040.00
Electrical Meter Act #100000163814 Consumption (kWh (thousand Watt-hours))		**88,240.00**
Electrical Meter Act #100000163814 Consumption (kBtu (thousand Btu))		**301,074.88**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**301,074.88**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity 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
Booster Station
2 Ford Road
Landing, NJ 07850

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Booster Station	
Gross Floor Area Excluding Parking: (ft^2)	816
Year Built	1980
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Entire Building	
Space Type	Other - Service (Vehicle Repair/Service, Postal Service)
Gross Floor Area(ft^2)	816
Number of PCs°	0
Weekly operating hours°	40
Workers on Main Shift°	3

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)	369	369	0	0	77
Source (kBtu/ft2)	1232	1232	0	0	150
Energy Cost					
$/year	$ 16,165.14	$ 16,165.14	N/A	N/A	$ 3,373.58
$/ft2/year	$ 19.81	$ 19.81	N/A	N/A	$ 4.13
Greenhouse Gas Emissions					
$MtCO_2e$/year	46	46	0	0	10
$kgCO_2e/ft^2$/year	56	56	0	0	12

More than 50% of your building is defined as Service (Vehicle Repair/Service, Postal Service). This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Service (Vehicle Repair/Service, Postal Service). This building uses X% less energy per square foot than the CBECS national average for Service (Vehicle Repair/Service, Postal Service).

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