ROXBURY TOWNSHIP
AJAX TERRACE SEWER TREATMENT PLANT GARAGE
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for the Roxbury Township Ajax Terrace Sewer Treatment Plant Garage located in Succasunna, New Jersey. The garage building totals approximately 5,600 square feet and houses an office, workshop, and a five bay garage.

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 Roxbury Township Ajax Terrace Sewer Treatment Plant Garage in Succasunna, New Jersey. The approximately 5,600 square foot building contains an office, workshop, and five-bay garage. The following areas were evaluated for energy conservation measures:

- Door seals
- Domestic hot water heater
- Infrared garage 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 $3,300 for the recommended ECMs may be realized with a payback of 6.5 years.

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

ECM-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
2,900	1.5	4,200	0	800	3.3	400	3.6	3.1

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

ECM-5 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
18,600	0	0	1,580	2,500	1.4	NA	7.4	NA

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

3.0 EXISTING CONDITIONS

3.1 Building General

3.1.1 Structure

The Roxbury Township Ajax Terrace Sewer Treatment Plant (STP) Garage was constructed in 1988. It is a 5,600 square foot, steel framed building on a concrete foundation with an aluminum siding exterior. The building has a first floor with no basement and houses STP vehicles, workshop, and small office. The windows are single pane glass original to the building's construction and are in acceptable condition. The building has five main garage doors in the front of the building; two additional garage doors in the rear are not typically used. There are also two emergency exit doors around the perimeter. The roof system is sloped with aluminum sheeting, and is in good condition.

3.1.2 Operating Hours

The garage operates approximately 30 hours per week year round.

3.2 Utility Usage

The garage uses electricity, and natural gas.

Electricity is purchased and delivered by Jersey Central Power & Light (JCP&L), and natural gas purchased and delivered by New Jersey Natural Gas (NJNG). The facility does not purchase municipal water.

For 2008, the garage had an annual electrical consumption of 14,900 kWh at a cost of $3,000, and natural gas usage of 7,700 therms at a cost of $4,900. The total utility bill for 2008 was $7,900. The largest portion of energy usage is for natural gas used for building heating as indicative of the higher usage trend during the colder months of November through April. The average rate for natural gas was $1.59 per therm. The summer cooling months show higher electrical usage. The average blended rate was $0.20 per kWh. Utility data is provided in Appendix A.

Electricity and natural gas commodity supply and delivery are presently purchased from JCP&L and NJNG, respectively. 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

3.3.1 Heating

The garage does not contain a central heating system. Space heating is provided by two ceiling-mounted 200,000 Btu/hr Reznor natural gas fired unit heaters, which distribute warm air to various parts of the structure. Heat is controlled by wall mounted thermostats. The heaters are typically set at 55°F; none of the thermostats are programmable.

3.3.2 Cooling

The building utilizes one small window air conditioning unit located in the rear office. The unit provides approximately 10,000 BTU of cooling and is controlled by an individual thermostat.

An equipment inventory is provided in Appendix B.

3.4 Lighting/Electrical Systems

The interior lighting within the garage is comprised of mainly inefficient T-12 fluorescent light fixtures. The T-12s are original to building construction and are a combination of 4' and 8' fixtures. There are also three 400-watt high bay metal halide fixtures in the bays. Lighting is controlled by individual switches in each space, and remains in use with occupancy.

The exit sign is an energy efficient LED that is wired individually to the building's main breakers. The building's exterior lighting consists of PAR38 floodlights over the garage doors. The exterior lighting is controlled by timers.

3.5 Plumbing Systems

The building does not contain a plumbing system.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Lighting Replacements

A comprehensive fixture survey was conducted of the Roxbury Township STP garage. 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' or 8' straight bulbs.

Overall energy consumption can be reduced by retrofitting approximately ten 8' 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' T-8 fluorescent lamps as required. In addition, there are three 400-watt high bay metal halide fixtures that can be replaced with more efficient high-output T-5 fixtures, each with five fluorescent lamps. The five 70-watt PAR38 flood lamps above the garage doors can be replaced with low-wattage compact fluorescent enclosed flood lamps with aluminum reflectors.

The fluorescent lighting retrofits have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 60,000 kWh and $12,000.

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
2,800	1.5	4,000	0	800	3.4	400	3.5	3.0

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

This measure is not recommended in lieu of ECM-3.

4.2 ECM-2 Install Occupancy Sensors

It is proposed that occupancy sensors be installed in the office area 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 the garage and workshop areas due to safety concerns.

Lighting fixtures throughout the garage 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 light is operated approximately 2,000 hours per year. Typical traffic patterns for each space were taken into account to approximate the actual occupancy hours per day. One occupancy sensor was proposed for the office space.

Lighting controls have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 3,000 kWh, and $1,500.

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
100	0.0	200	0	100	4.5	NA	1.0	NA

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

This measure is not recommended in lieu of 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 the manufacturer, and total energy savings over the life of the project are estimated at 589,5000 kWh, and $97,500.

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
2,900	1.5	4,200	0	800	3.3	400	3.6	3.1

*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. In addition, the two rear garage doors are deteriorating and have visible penetrations. This measure determined the perimeter length and gap spacing of the 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 34,000 kWh, 1,000 therms and $2,000.

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

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
3,400	0	0	100	200	-0.4	NA	17	NA

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

This measure is not recommended.

4.5 ECM-5 Install Infrared Garage Heaters

Five gas-fired unit heaters, operating with a thermal efficiency of about 75%, are used to heat the garage area. 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 require approximately 4,900 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 1,580 therms.

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, five 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 28,440 therms, totaling $45,000.

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

ECM-5 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
18,600	0	0	1,580	2,500	1.4	NA	7.4	NA

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

This measure is recommended.

5.0 POTENTIAL INCENTIVES

5.1 Incentives Overview

The Roxbury STP Garage 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 associated with development of 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 5,600 square foot building, Incentive #1 corresponds to approximately $200. 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 $10,700 and would reduce payback from 7.9 to 5.3 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). The total amount of all qualified incentives is about $400.

As noted previously, a project cannot apply for incentives from both the P4P Program and the SmartStart Buildings Program for the same project. See Appendix F 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 Roxbury STP Garage is heated by two natural gas fired unit heaters. Cooling is facilitated with one window AC unit. To take advantage of a GHP system, the building would have to install a low temperature closed loop water source heat pump system as well as vertical bore field 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 low usage loads 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 G.

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 6.6 kW and a minimum kW of 3.6 kW in 2008. The monthly average over the observed 12 month period was 4.6 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	500	500	2,000	1200	>30	11.0

*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 not hot water usage therefore 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 H.

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 is located in a residential area, noise may be an issue.

This measure is not recommended due to limited use of heat created by the CHP plant.

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 the high moisture content of the STP sludge, making the present system configuration to produce thermal energy or electricity impractical.

6.6 Demand Response Curtailment

Presently, the garage has electricity delivered and supplied by 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. JCP&L 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, indicated that existing emergency generators will not pass the emissions requirements to enter the program.

Presently, the building has no back up generation. During the observed period an average of 4.6 kW per month was needed.

This is not recommended because of the small building load.

7.0 EPA PORTFOLIO MANAGER

The United States Environmental Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The program is designed to allow property owners and managers to share, compare and improve upon their 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 an office area, workshop, and garage. 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 a site energy intensity of 96 kBTU/ft^2.

The building's performance, however, can be compared to national site and source EUI averages. With a site energy intensity of 96 kBTU/ft^2/year, the building is considered a moderate energy consumer per the Portfolio Manager. Reducing energy loss associated with lighting retrofit, door seals, window repair, and replacing the unit heaters with infrared technology 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 65 kBTU/ft^2/year can be obtained.

A full EPA Energy Star Portfolio Manager Report is located in Appendix I. 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 Ajax Terrace Sewer Treatment Plant Garage located in Succasunna, New Jersey identified potential ECMs for lighting upgrades with occupancy sensors, and door seal replacement, and installation of infrared garage heaters. Potential annual savings of $3,300 may be realized for the recommended ECMs, with a summary of the cost, savings, and payback 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
2,900	1.5	4,200	0	800	3.3	400	3.6	3.1

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

ECM-5 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
18,600	0	0	1,580	2,500	1.4	NA	7.4	NA

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

APPENDIX A

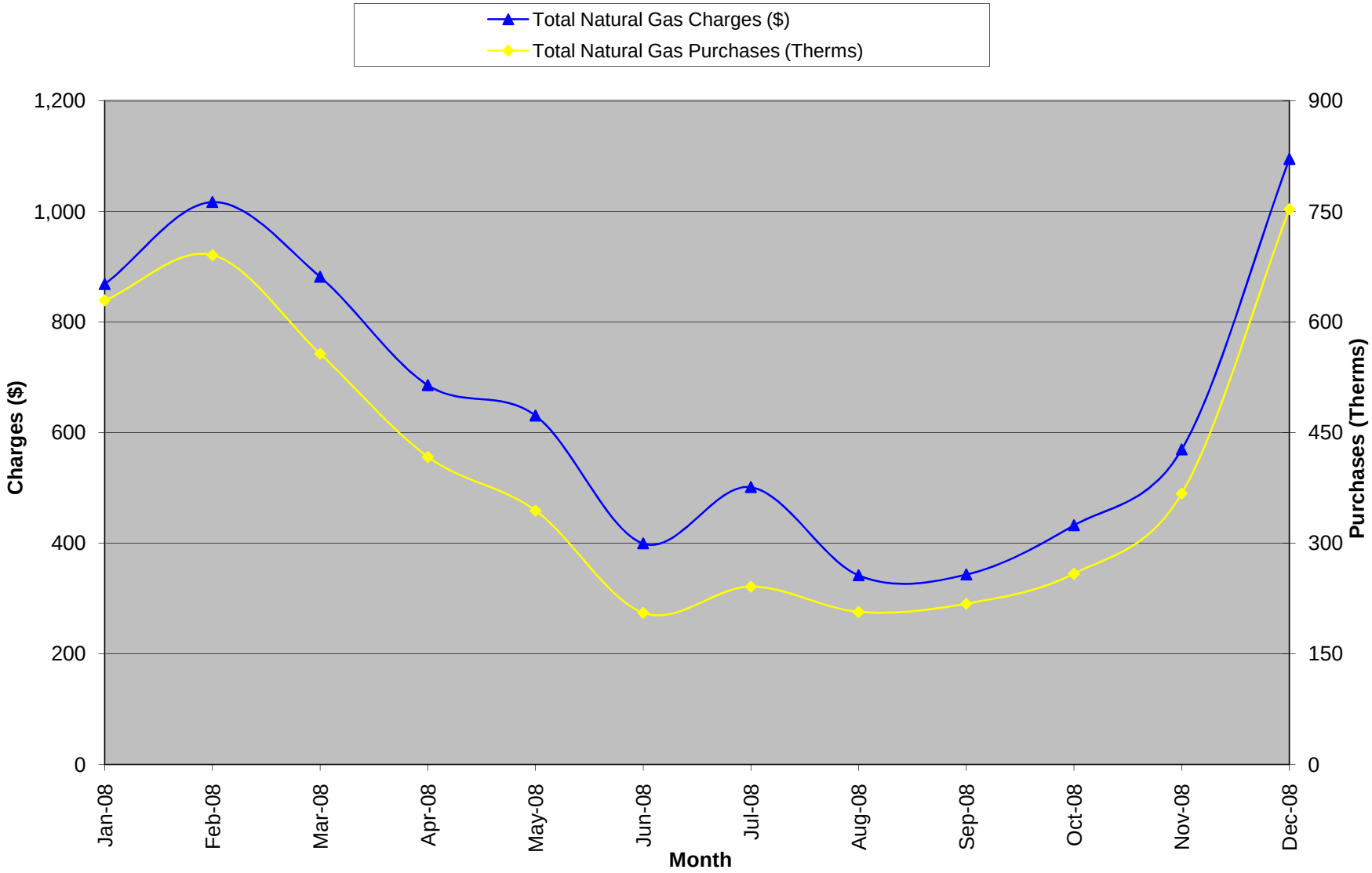
Utility Usage Analysis

New Jersey BPU Energy Audit Program
CHA #20556
Township of Roxbury Sewer Treatment Plant Garage

Natural Gas

	Date	Charge ($)	Total Therms	$/therm
1	January-08	868.46	629.2754	1.38
2	February-08	1,016.76	690.7041	1.47
3	March-08	881.68	556.9240	1.58
4	April-08	685.78	417.1676	1.64
5	May-08	630.81	344.2360	1.83
6	June-08	399.45	205.6628	1.94
7	July-08	501.26	241.0912	2.08
8	August-08	341.95	206.7996	1.65
9	September-08	343.33	217.8675	1.58
10	October-08	432.32	258.6444	1.67
11	November-08	569.44	367.2527	1.55
12	December-08	1,094.77	752.9934	1.45
	Total	$ 7,766	4,888.6187	**$1.59**

Natural Gas Usage - Township of Roxbury
Sewer Treatment Plant Garage



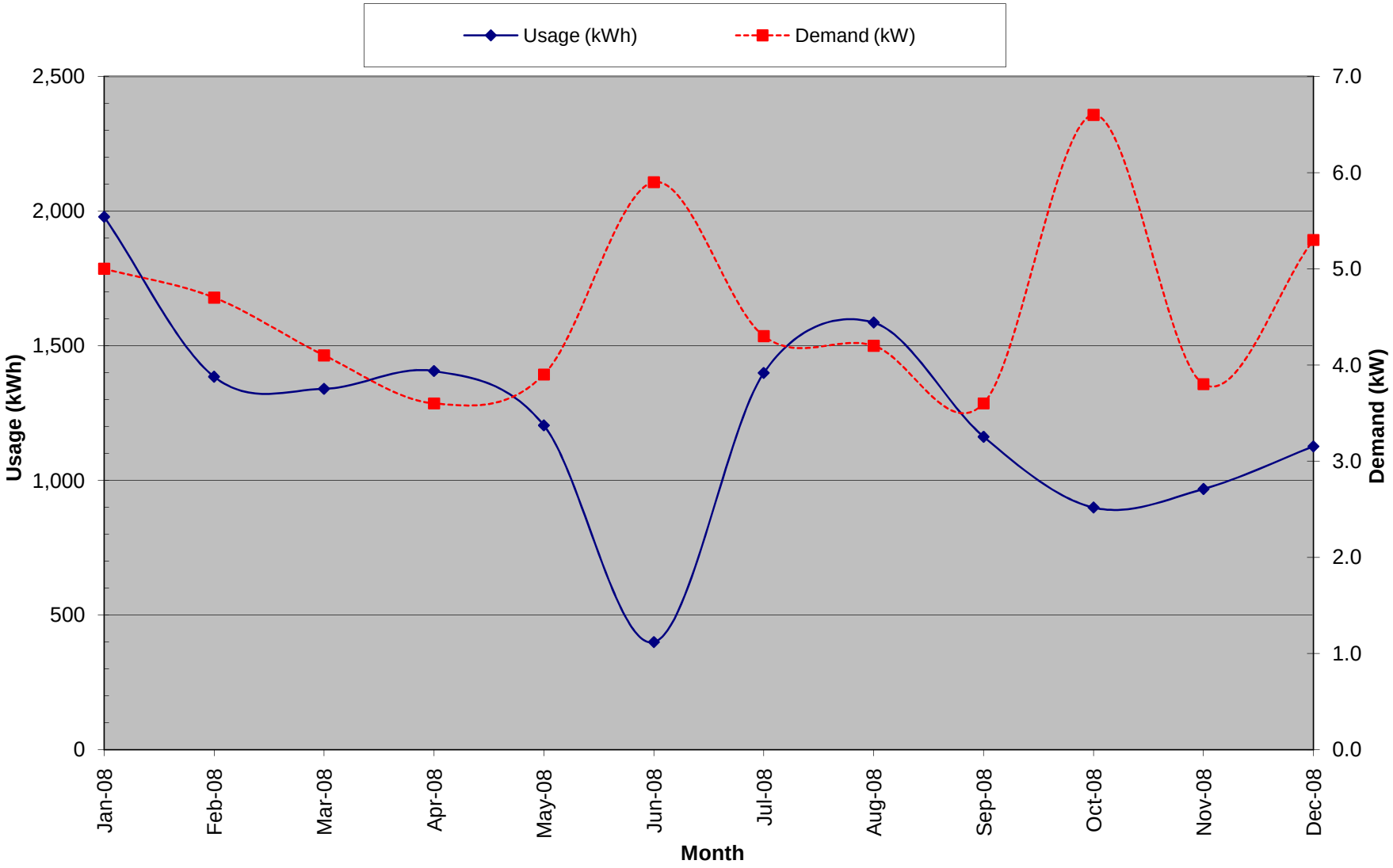
Utility Data - RoxburySewerTreatmentGarage.xls
Natural Gas Chart

New Jersey BPU Energy Audit Program
CHA #20556
Building: Township of Roxbury Sewer Treatment Plant Garage

Account Number: 10 00 00 1327 8 5
Jersey Central Power and Lighting

	Electricity							Electricity										
	Period	Supply kWH	Delivery KW	Cost ($)	Blended Rate ($/kWH)	Unit Cost ($/kWH)	Unit Cost ($/kW)	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	Total
1	1/1/2008	1,979	5.0	329.28	0.1664	0.1664	-	$11.65	$186.96	$10.67	$6.98	$62.22	$0.00	$33.56	$11.29	$5.79	$0.16	$329.28
2	2/1/2008	1,385	4.7	249.24	0.1800	0.1800	-	$11.65	$130.85	$7.01	$4.89	$59.28	$0.00	$23.49	$7.90	$4.06	$0.11	$249.24
3	3/1/2008	1,340	4.1	236.48	0.1765	0.1765	-	$11.65	$126.60	$6.80	-$2.04	$59.06	$0.00	$22.73	$7.65	$3.92	$0.11	$236.48
4	4/1/2008	1,406	3.6	241.42	0.1717	0.1717	-	$11.65	$132.83	$7.13	-$5.67	$59.38	$0.00	$23.85	$8.02	$4.12	$0.11	$241.42
5	5/1/2008	1,204	3.9	215.95	0.1794	0.1794	-	$11.65	$113.75	$6.11	-$4.86	$58.38	$0.00	$20.42	$6.87	$3.53	$0.10	$215.95
6	6/1/2008	399	5.9	255.10	0.6393	0.6393	-	$11.65	$147.48	$6.08	-$3.88	$62.99	$0.00	$20.34	$6.84	$3.51	$0.09	$255.10
7	7/1/2008	1,399	4.3	292.72	0.2092	0.2092	-	$11.65	$178.04	$7.09	-$3.96	$63.98	$0.00	$23.73	$7.98	$4.10	$0.11	$292.72
8	8/1/2008	1,586	4.2	322.66	0.2034	0.2034	-	$11.65	$201.83	$8.04	-$4.49	$64.91	$0.00	$26.90	$9.05	$4.64	$0.13	$322.66
9	9/1/2008	1,162	3.6	250.21	0.2153	0.2153	-	$11.65	$147.87	$5.89	-$7.83	$62.80	$0.00	$19.71	$6.63	$3.40	$0.09	$250.21
10	10/1/2008	899	6.6	181.04	0.2014	0.2014	-	$11.65	$97.81	$4.74	-$7.81	$51.57	$0.00	$15.25	$5.13	$2.63	$0.07	$181.04
11	11/1/2008	968	3.8	194.80	0.2012	0.2012	-	$11.65	$105.32	$5.18	-$8.40	$55.53	$0.00	$16.42	$6.19	$2.83	$0.08	$194.80
12	12/1/2008	1,126	5.3	223.25	0.1983	0.1983	-	$11.65	$122.51	$6.02	-$4.67	$57.99	$0.00	$19.10	$7.26	$3.30	$0.09	$223.25
Total		14,853	6.6	$ 2,992	0.2015	0.2015	-	$139.80	$1,691.85	$80.76	-$41.74	$718.09	$0.00	$265.50	$90.81	$45.83	$1.25	

Electric Usage - Township of Roxbury
Sewer Treatment Plant Garage



Utility Data - RoxburySewerTreatmentGarage.xls
Electricity Chart

ELECTRIC MARKETERS LIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GAS MARKETERS LIST

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX B

Equipment Inventory

NJBPU Energy Audits
CHA Project No. 20556
Township of Roxbury
Waste Water Treatment Plant Garage

Equipment Inventory

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy (years)	Other Info.
Gas Fired Unit Heater #1	Reznor ITT	Mod:XL-200 Ser:AFA31B6N064	Unit Heater (NG)	200,000 Btu In 160,000 Btu Out	Garage	Garage	1980's	30	
Gas Fired Unit Heater #2	Reznor ITT	Mod:XL-200 Ser:AFA31B6N064	Unit Heater (NG)	200,000 Btu In 160,000 Btu Out	Garage	Garage	1980's	30	
Window AC Unit	NA	NA	Window AC unit	7500 Btu	Garage	Garage Office	1990's	20	

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 - Sewer Treatment Plant Garage

Existing Lighting

Cost of Electricity: **$0.202 $/kWh**

$0.00 $/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
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	None	828	
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	None	828	
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	None	1,242	
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	None	1,242	
9	Garage Area	3	High Bay MH 400	MH400/1	458	1.4	SW	2000	None	2,748	
171	Office Area	3	W 34 C F 2 (MAG)	F42EE	72	0.2	SW	2000	OCC	432	
X1	Garage Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	None	26	
226	Above Front Doors	5	70 W MH	MH70/1	95	0.5	Timer	4368	None	2,075	
226	Back of Garage	1	70 W MH	MH70/1	95	0.1	Timer	4368	None	415	
	Total	**24**				**4.2**				**9,836**	

Energy Audit of Roxbury Township

CHA Project No. 20556 - Sewer Treatment Plant Garage

ECM-1 Lighting Replacements

Cost of Electricity: **$0.202 $/kWh**

$0.00 $/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 $ 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)	(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
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828	2	S 86 P F 2 8' T-8	F82LHL	160	0.3	SW	2,000	640	188	$ 37.88	$ 287.50	$0	7.6	7.6
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828	2	S 86 P F 2 8' T-8	F82LHL	160	0.3	SW	2,000	640	188	$ 37.88	$ 287.50	$0	7.6	7.6
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242	3	S 86 P F 2 8' T-8	F82LHL	160	0.5	SW	2,000	960	282	$ 56.82	$ 431.25	$0	7.6	7.6
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242	3	S 86 P F 2 8' T-8	F82LHL	160	0.5	SW	2,000	960	282	$ 56.82	$ 431.25	$0	7.6	7.6
9	Garage Area	3	High Bay MH 400	MH400/1	458	1.4	SW	2000	2,748	3	P 54 C F 4	F45GHL	294	0.9	SW	2,000	1,764	984	$ 198.28	$ 900.00	$300	4.5	3.0
171	Office Area	3	W 34 C F 2 (MAG)	F42EE	72	0.2	SW	2000	432	3	W 28 W F 2	F42SSILL	48	0.1	SW	2,000	288	144	$ 29.02	$ 344.25	$45	11.9	10.3
X1	Garage Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8,760	26	-	$ -	$ -	$0		
226	Above Front Doors	5	70 W MH	MH70/1	95	0.5	Timer	4368	2,075	5	CF 20	CFS20/1	20	0.1	Timer	4,368	437	1,638	$ 330.06	$ 93.75	$35	0.3	0.2
226	Back of Garage	1	70 W MH	MH70/1	95	0.1	Timer	4368	415	1	CF 20	CFS20/1	20	0.0	Timer	4,368	87	328	$ 66.01	$ 18.75	$7	0.3	0.2
	Total	**24**				**4.2**			**9,836**	**24**			**1,024**	**3**			**5,802**	**4,034**	**$813**	**$2,794**	**$387**		
																	Demand Savings		**1**	**0.0**			
																	kWh Savings		**4,034**	**813**			
																	Total savings			**$813**		**3.4**	**3.0**

Energy Audit of Roxbury Township

CHA Project No. 20556 - Sewer Treatment Plant Garage

Cost of Electricity: **$0.202 $/kWh**

$0.00 $/kW

ECM-2 Install Occupancy Sensors

		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 $ 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)	(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
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828.0	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	None	2000	828.0	0.0	$0.00	$0.00	$0.00		
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828.0	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	None	2000	828.0	0.0	$0.00	$0.00	$0.00		
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242.0	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	None	2000	1,242.0	0.0	$0.00	$0.00	$0.00		
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242.0	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	None	2000	1,242.0	0.0	$0.00	$0.00	$0.00		
9	Garage Area	3	High Bay MH 400	MH400/1	458	1.4	SW	2000	2,748.0	3	High Bay MH 400	MH400/1	458	1.4	None	2000	2,748.0	0.0	$0.00	$0.00	$0.00		
171	Office Area	3	W 34 C F 2 (MAG)	F42EE	72	0.2	SW	2000	432.0	3	W 34 C F 2 (MAG)	F42EE	72	0.2	OCC	1000	216.0	216.0	$43.52	$118.75	$20.00	2.7	2.3
X1	Garage Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26.3	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	26.3	0.0	$0.00	$0.00	$0.00		
226	Above Front Doors	5	70 W MH	MH70/1	95	0.5	Timer	4368	2,074.8	5	70 W MH	MH70/1	95	0.5	None	4368	2,074.8	0.0	$0.00	$0.00	$0.00		
226	Back of Garage	1	70 W MH	MH70/1	95	0.1	Timer	4368	415.0	1	70 W MH	MH70/1	95	0.1	None	4368	415.0	0.0	$0.00	$0.00	$0.00		
	Total	**24**				**4.2**			**9,836**	**24**				**4.2**			**9,620**	**216**	**44**	**$119**	**20**		
																		Demand Savings	**0.0**	**0.0**			
																		kWh Savings	**216**	**44**			
																		Total Savings		**44**		**$3**	**2.3**

Energy Audit of Roxbury Township

CHA Project No. 20556 - Sewer Treatment Plant Garage

ECM-3 Lighting Replacements with Occupancy Sensors

Cost of Electricity: **$0.202 $/kWh**

$0.00 $/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 $ 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)	(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
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828	2	S 86 P F 2 8' T-8	F82LHL	160	0.3	None	2,000	640	188	$ 37.88	$ 287.50	$ -	7.6	7.6
204	Garage Area	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	2000	828	2	S 86 P F 2 8' T-8	F82LHL	160	0.3	None	2,000	640	188	$ 37.88	$ 287.50	$ -	7.6	7.6
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242	3	S 86 P F 2 8' T-8	F82LHL	160	0.5	None	2,000	960	282	$ 56.82	$ 431.25	$ -	7.6	7.6
204	Garage Area	3	S 96 P F 2 (MAG) 8'	F82EHE	207	0.6	SW	2000	1,242	3	S 86 P F 2 8' T-8	F82LHL	160	0.5	None	2,000	960	282	$ 56.82	$ 431.25	$ -	7.6	7.6
9	Garage Area	3	High Bay MH 400	MH400/1	458	1.4	SW	2000	2,748	3	P 54 C F 4	F45GHL	294	0.9	None	2,000	1,764	984	$ 198.28	$ 900.00	$ 300	4.5	3.0
171	Office Area	3	W 34 C F 2 (MAG)	F42EE	72	0.2	SW	2000	432	3	W 28 W F 2	F42SSILL	48	0.1	OCC	1,000	144	288	$ 58.03	$ 463.00	$ 65	8.0	6.9
X1	Garage Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	26	-	$ -	$ -	$ -		
226	Above Front Doors	5	70 W MH	MH70/1	95	0.5	Timer	4368	2,075	5	CF 20	CFS20/1	20	0.1	None	4,368	437	1,638	$ 330.06	$ 93.75	$ 35	0.3	0.2
226	Back of Garage	1	70 W MH	MH70/1	95	0.1	Timer	4368	415	1	CF 20	CFS20/1	20	0.0	None	4,368	87	328	$ 66.01	$ 18.75	$ 7	0.3	0.2
	Total	**24**				**4.2**			**9,836**	**24**				**2.7**			**5,658**		**842**	**2,913**	**407**		
																		Demand Savings		**1**	**0.0**		
																		kWh Savings		**4,178**	**842**		
																		Total Savings			$842		**$3**	**3.0**

Energy Audit of Roxbury Township
CHA Project No. 20556 - Sewer Treatment Plant Garage
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**
9	High Bay MH 400	MH400/1	458	Replace	P 54 C F 4	F45GHL	294													**$100.00**	**$300.00**
171	W 34 C F 2 (MAG)	F42EE	72	RL/RB	W 28 W F 2	F42SSILL	48						$20.00	$45.00	INC	$10.00	$10.00	INC	$29.75	**$15.00**	**$114.75**
204	S 96 P F 2 (MAG) 8'	F82EHE	207	RL/RB	S 86 P F 2 8' T-8	F82LHL	160						$20.00	$45.00	INC	$30.00	$20.00	INC	$28.75		**$143.75**
226	70 W MH	MH70/1	95	Replace	CF 20	CFS20/1	20	1								$15.00	INC	INC	$3.75	**$7.00**	**$18.75**
OCC	OCCUPANCY SENSOR SWITCH									$50	$45	INC							$23.75	**$20.00**	**$118.75**
C-OCC	OCC SENSOR W/ 20 FT. WIRE TO CEILING									$100	$50	INC							$52.50	**$35.00**	**$202.50**

Rebuild Notes:
(1) Replace with client requested fixtures
(2) 2' x 2' U-Tube to 17 w 2' lamps with Reflector Kit Vendor Code RK(2F17t)

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	
Screw-in PAR 38 or PAR 30 (CFL) with Alum. Reflectors replacing incandescents	N/A	1	$7	
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	
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 - Sewer Treatment Plant Garage
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
Outdoor Lighting	12	4368	4368	Y
Garage		2000	1000	Y

APPENDIX D

ECM-4 Install Door Seals

NJBPU Energy Audits
CHA Project No. 20556
Building: Waste Water Treatment Plant Garage

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	75%		Ex Occupied Clng Temp.	N/A	*F	Ex Occupied Htg Temp.	55	*F
Cooling System Efficiency	N/A	kW/ton	Ex Unoccupied Clng Temp.	N/A	*F	Ex Unoccupied Htg Temp.	55	*F
			Prop Occupied Clng Temp.	N/A	*F	Prop Occupied Htg Temp.	55	*F
Linear Feet of Door Edge	410		Prop Unoccupied Clng Temp.	N/A	*F	Prop Unoccupied Htg Temp.	55	*F
Existing Infiltration Factor*	0.5	cfm/LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.20	$/kWh
Proposed Infiltration Factor*	0.2	cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.59	$/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	2	1	0	0	0	0	0	0	0	0
92.5	39.5	34	17	17	0	0	0	0	0	0	0	0
87.5	36.6	131	66	65	0	0	0	0	0	0	0	0
82.5	34.0	500	252	248	0	0	0	0	0	0	0	0
77.5	31.6	620	313	307	0	0	0	0	0	0	0	0
72.5	29.2	664	335	329	0	0	0	0	0	0	0	0
67.5	27.0	854	431	423	0	0	0	0	0	0	0	0
62.5	24.5	927	468	459	0	0	0	0	0	0	0	0
57.5	21.4	600	303	297	0	0	0	0	0	0	0	0
52.5	18.7	610	308	302	554	554	221	221	0	0	5	2
47.5	16.2	611	308	303	1,661	1,661	664	664	0	0	14	5
42.5	14.4	656	331	325	2,769	2,769	1,107	1,107	0	0	24	10
37.5	12.6	1,023	516	507	3,876	3,876	1,550	1,550	0	0	53	21
32.5	10.7	734	370	364	4,984	4,984	1,993	1,993	0	0	49	20
27.5	8.6	334	169	165	6,091	6,091	2,436	2,436	0	0	27	11
22.5	6.8	252	127	125	7,198	7,198	2,879	2,879	0	0	24	10
17.5	5.5	125	63	62	8,306	8,306	3,322	3,322	0	0	14	6
12.5	4.1	47	24	23	9,413	9,413	3,765	3,765	0	0	6	2
7.5	2.6	22	11	11	10,521	10,521	4,208	4,208	0	0	3	1
2.5	1.0	13	7	6	11,628	11,628	4,651	4,651	0	0	2	1
-2.5	0.0	0	0	0	12,736	12,736	5,094	5,094	0	0	0	0
-7.5	-1.5	0	0	0	13,843	13,843	5,537	5,537	0	0	0	0
TOTALS		**8,760**	**4,420**	**4,340**					**0**	**0**	**220**	**88**

Existing Door Infiltration	**205**	**cfm**
Existing Unoccupied Door Infiltration	**205**	**cfm**
Proposed Door Infiltration	**82**	**cfm**
Proposed Unoccupied Door Infiltration	**82**	**cfm**

Savings	**132**	**therms**	**$ 210**
		kWh	**$ -**
	Total		**$ 210**

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
Entry Door	3.5	7.5	22	0.25	all sides	22	100%	0.25
Entry Door	3.5	7.5	22	0.25	all sides	22	100%	0.25
Garage Door Front	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Front	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Front	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Front	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Front	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Rear	12	14	52	0.25	all sides	52	100%	0.25
Garage Door Rear	12	14	52	0.25	all sides	52	100%	0.25
Rear Garage Door Hole	0.8	0.3	2.2	3.0	NA	4.0	100%	3.00
Total	**91.8**	**113.3**	**410.2**	**0.53**		**412**	**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: Waste Water Treatment Plant Garage

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 (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Door Seals (Garage door - 12' x 14')	52	ln-ft	$ 3	$ 3	$ -	$ 154	$ 190	$ -	$ 345	
Repair Hole in Rear Garage Door	1	ea	$ 75	$ 100		$ 74	$ 122	$ -	$ 196	
						$ -	$ -	$ -	$ -	

$ 2,801	Subtotal
$ 280	10% Contingency
$ 308	10% Contractor O&P
$ -	0% Engineering
$ 3,389	**Total**

APPENDIX E

ECM-5 Install Infrared Garage Heaters

NJBPU Energy Audits
CHA Project No. 20556
Waste Water Treatment Plant Garage

ECM - 5 Install Infrared Garage Heaters

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	25	feet
Existing Unit Capacity	=	400	MBtu/hr
Energy Heating Value	=	100	Mbh/Therm
Fuel Cost	=	$ 1.59	$/therm
Operating hours per year	=	3,206	hours

Assumption

Radiant adjustment to heat loss	=	85%
Part Load Percentage	=	28%
Existing Heating Efficiency	=	75%

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss = (	25	-	20) x (	0.01	) +	1.0	= **1.05**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val		
Existing Bldg Energy L = (	400	) x (	28%	) x (	3,206	) / (	75%	) / (	100	) =	**4,788 therms**

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use = (	400	) x (	28%	) x (	85%	) x (	1.05	) x (	3,206	) / (	100	) =	**3,205 therms**

	Energy use		fuel rate		
Existing Cost	= (4,788	)*(	$1.59) =		**$7,606**
New Cost	= (3,205	)*(	$1.59) =		**$5,091**

Result

Annual Existing Heating Use	**4,788**	**therms**	**=>**	**$7,606**	
Annual Proposed Heating Use	**3,205**	**therms**	**=>**	**$5,091**	
Annual Proposed Heating Savings at	**1,583**	**therms**	**=>**	**$2,515**	**33% of existing**

Engineering Check:		
Actual	**Calc**	**%**
4,889	**4,788**	**102%**

Comment

NJBPU Energy Audits
CHA Project No. 20556
Building: Waste Water Treatment Plant Garage

ECM - 5 Install Infrared Garage Heaters

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.		
									$ -	
Install (5) 105 MBh Infrared Unit Heaters Over Each Bay to Replace (2) Existing 200 MBh units	5	ea	$ 645	$ 355	$ -	$ 3,193	$ 2,166	$ -	$ 5,358	2009-Mechanical MEANS
Existing Unit Heater Removal and Disposal	2	ea	$ 50	$ 90	$ -	$ 99	$ 220	$ -	$ 319	Estimate
Misc.	5	LS	$ 500			$ 2,475	$ -	$ -	$ 2,475	Estimate
Venting Kit	5	EA	$ 250	$ 400		$ 1,238	$ 2,440	$ -	$ 3,678	2009-Mechanical MEANS
Misc. Piping 3/4 in	175	LF	$ 6.00	$ 5.15		$ 1,040	$ 1,100	$ -	$ 2,139	2009-Mechanical MEANS
Misc. Valves 3/4 in	5	LS	$ 17.00	$ 20.00		$ 84	$ 122	$ -	$ 206	2009-Mechanical MEANS
Thermostats	5	ea	$ 50	$ 47		$ 248	$ 287	$ -	$ 534	2009-Mechanical MEANS

$ 14,709	Subtotal
$ 2,206	15% Contingency
$ 1,692	10% Contractor O&P
$ -	0% Engineering
$ 18,607	**Total**

APPENDIX F

New Jersey Pay For Performance Incentive Program

NJBPU Energy Audits
CHA Project No. 20556
Waste Water Treatment Plant Garage

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	14,853	4,889
Proposed Savings	4,178	1,715
Existing Total MMBtus	540	
Proposed Savings MMBtus	186	
% Reduction	34.4%	
Proposed Annual Savings*	$2,515	

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	$919	$3,773	$4,692
Incentive #3	$585	$2,401	$2,986
Totals	**$1,504**	**$6,174**	**$7,678**

Total Project Cost	$21,520
% Incentives of Project Cost*	35.7%
Project Cost w/ Incentives*	$13,842

Project Payback (years)	
w/o Incentives	w/ Incentives
8.6	5.5

* 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	4,178	1,583
Proposed Savings MMBtus	173	
% Reduction	32.0%	

APPENDIX G

Photovoltaic (PV) Rooftop Solar Power Generation

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.

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

Disclaimer and copyright notice

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

Roxbury Waste Water Treatment Maintenance Garage

Cost of Electricity $0.20 $/kWh

ECM-6.2 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**	**$473**	**0**	**$473**	**$2,000**	**$1,151**	**42.3**	**11.1**

*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**

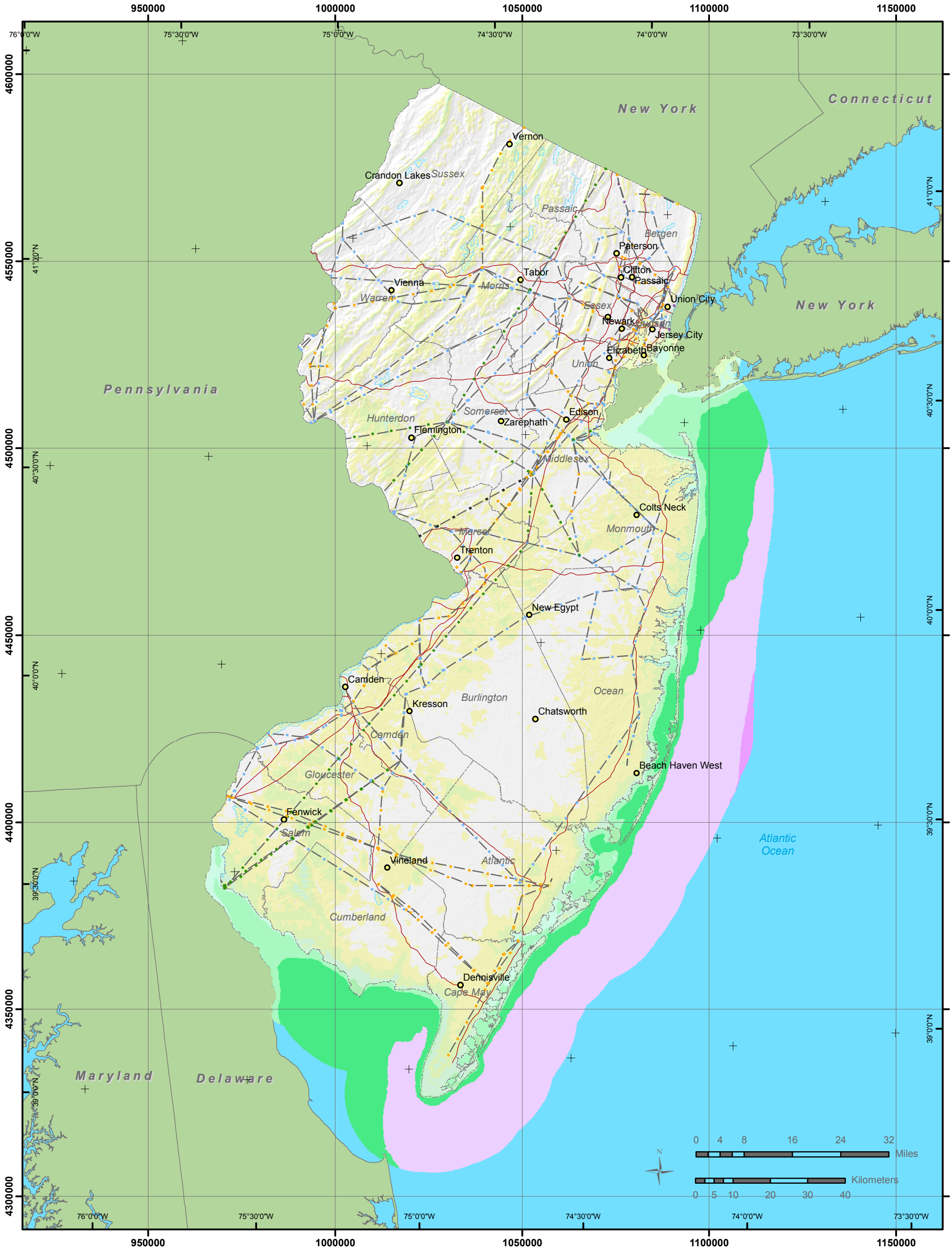

N
© 2010 Google
Google
Imagery Date: Jul 5, 2007
40°50'36.47" N
74°38'33.09" W
elev 689 ft
Eye alt 955 ft

APPENDIX H

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 I

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Sewer Treatment Plant Garage

Building ID: 1933107
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 02, 2010

Facility
Sewer Treatment Plant Garage
2 Ajax Terrace
Succasunna, NJ 07876

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1988
Gross Floor Area (ft²): 5,600

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	50,678
Natural Gas (kBtu)[4]	488,861
Total Energy (kBtu)	539,539

Energy Intensity[5]

Site (kBtu/ft²/yr)	96
Source (kBtu/ft²/yr)	122

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	34

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-43%
Building Type	Other

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	Sewer Treatment Plant Garage	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	2 Ajax Terrace, Succasunna, NJ 07876	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		☐
Garage (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	5,600 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	30Hours(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	7(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 #100000132785 (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	1,126.00
11/01/2008	11/30/2008	968.00
10/01/2008	10/31/2008	899.00
09/01/2008	09/30/2008	1,162.00
08/01/2008	08/31/2008	1,586.00
07/01/2008	07/31/2008	1,399.00
06/01/2008	06/30/2008	399.00
05/01/2008	05/31/2008	1,204.00
04/01/2008	04/30/2008	1,406.00
03/01/2008	03/31/2008	1,340.00
02/01/2008	02/29/2008	1,385.00
01/01/2008	01/31/2008	1,979.00
Electrical Meter Act #100000132785 Consumption (kWh (thousand Watt-hours))		**14,853.00**
Electrical Meter Act #100000132785 Consumption (kBtu (thousand Btu))		**50,678.44**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**50,678.44**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas Meter Act #01-1103-0810-12 (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	752.99
11/01/2008	11/30/2008	367.25
10/01/2008	10/31/2008	258.64
09/01/2008	09/30/2008	217.87
08/01/2008	08/31/2008	206.80
07/01/2008	07/31/2008	241.09
06/01/2008	06/30/2008	205.66
05/01/2008	05/31/2008	344.24
04/01/2008	04/30/2008	417.17
03/01/2008	03/31/2008	556.92

02/01/2008	02/29/2008	690.70
01/01/2008	01/31/2008	629.28
Natural Gas Meter Act #01-1103-0810-12 Consumption (therms)		**4,888.61**
Natural Gas Meter Act #01-1103-0810-12 Consumption (kBtu (thousand Btu))		**488,861.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**488,861.00**
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
Sewer Treatment Plant Garage
2 Ajax Terrace
Succasunna, NJ 07876

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Sewer Treatment Plant Garage	
Gross Floor Area Excluding Parking: (ft^2)	5,600
Year Built	1988
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Garage	
Space Type	Other - Other
Gross Floor Area(ft^2)	5,600
Number of PCs[o]	0
Weekly operating hours[o]	30
Workers on Main Shift[o]	7

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	96	96	0	0	104
Source (kBtu/ft^2)	122	122	0	0	213
Energy Cost					
$/year	$ 10,758.16	$ 10,758.16	N/A	N/A	$ 11,612.34
$/$ft^2$/year	$ 1.92	$ 1.92	N/A	N/A	$ 2.07
Greenhouse Gas Emissions					
$MtCO_2e$/year	34	34	0	0	37
$kgCO_2e/ft^2$/year	6	6	0	0	6

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

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