CITY OF EAST ORANGE

WATER DEPARTMENT PUMP HOUSE

300 Parsonage Hill Road, Short Hill, NJ, 07078

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM
FOR
NEW JERSEY
BOARD OF PUBLIC UTILITIES

May 2016

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CHA PROJECT NO. 30993

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REPORT DISCLAIMER

This audit was conducted in accordance with the standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for a Level II audit. Cost and savings calculations for a given measure were estimated to within ±20%, and are based on data obtained from the owner, data obtained during site observations, professional experience, historical data, and standard engineering practice. Cost data does not include soft costs such as engineering fees, legal fees, project management fees, financing, etc.

A thorough walkthrough of the building was performed, which included gathering nameplate information and operating parameters for all accessible equipment and lighting systems. Unless otherwise stated, model, efficiency, and capacity information included in this report were collected directly from equipment nameplates and /or from documentation provided by the owner during the site visit. Typical operation and scheduling information was obtained from interviewing staff and spot measurements taken in the field.

List of Common Energy Audit Abbreviations

- A/C – Air Conditioning
- AHS – Air Handling Unit
- BMS – Building Management System
- Btu – British thermal unit
- CDW – Condenser Water
- CFM – Cubic feet per minute
- CHW – Chilled Water
- DCV – Demand Control Ventilation
- DDC – Direct Digital Control
- DHW – Domestic Hot Water
- DX – Direct Expansion
- EER – Energy Efficiency Ratio
- EF – Exhaust Fan
- EUI – Energy Use Intensity
- Gal – Gallon
- GPD – Gallons per day
- GPF – Gallons Per Flush
- GPH – Gallons per hour
- GPM – Gallons per minute
- GPS – Gallons per second
- HHW – Heating Hot Water
- HID – High Intensity Discharge
- HP – Horsepower
- HRU – Heat Recovery Unit
- HVAC – Heating, Ventilation, Air Conditioning
- HX – Heat Exchanger
- kbtu/mbtu – One thousand (1,000) Btu
- kW – Kilowatt (1,000 watts)
- kWh – Kilowatt-hours
- LED – Light Emitting Diode
- mbh – Thousand Btu per hour
- mmbtu – One million (1,000,000) Btu
- OCC – Occupancy Sensor
- PSI – Pounds per square inch
- RTU – Rooftop Unit
- SBC – System Benefits Charge
- SF – Square foot
- UH – Unit Heater
- V – Volts
- VAV – Variable Air Volume
- VSD – Variable Speed Drive
- W – Watt

1.0 EXECUTIVE SUMMARY

This report summarizes the energy audit performed by CHA for City of East Orange in connection with the New Jersey Board of Public Utilities (NJBPU) Local Government Energy Audit (LGEA) Program. The purpose of this report is to identify energy savings opportunities associated with major energy consumers and inefficient practices. Low-cost and no-cost energy conservation measures (ECMs) have also been identified in this study. This report details the results of the energy audit conducted for the building listed below:

Building Name	Address	Square Feet	Construction Date
Water Department Pump House	300 Parsonage Hill Road, Short Hill, NJ, 07078	20,564	1910

The potential total annual energy and cost savings for the recommended energy conservation measures (ECM) identified in the survey are shown below:

City Hall	Electric Savings (kWh)	Fuel Oil#2 (gallons)	Total Savings ($)	Payback (years)
Water Department Pump House	112,451	2,205	25,191	12.5

Each individual measure's annual savings are dependent on that measure alone, there are no interactive effects calculated. There are three options shown for lighting ECM savings; only one option can be chosen. The incentives shown (if any) are based only on the SmartStart Incentive Program. Other NJBPU or local utility incentives may also be available/applicable and are further discussed in Section 6.0.

Each measure recommended by CHA typically has a stand-alone simple payback period of 15 years or less. However, if the owner choses to pursue an Energy Savings Improvement Plan (ESIP), high payback measures could be bundled with lower payback measures which ultimately can result in a payback which is favorable for an ESIP project to proceed. Occasionally, we will recommend an ECM that has a longer payback period. This decision is generally based on the need to replace the piece(s) of equipment due to its age, such as a boiler.

The following table provides a detailed summary of each ECM for the building surveyed, including costs, savings, SmartStart incentives and payback.

Summary of Energy Conservation Measures

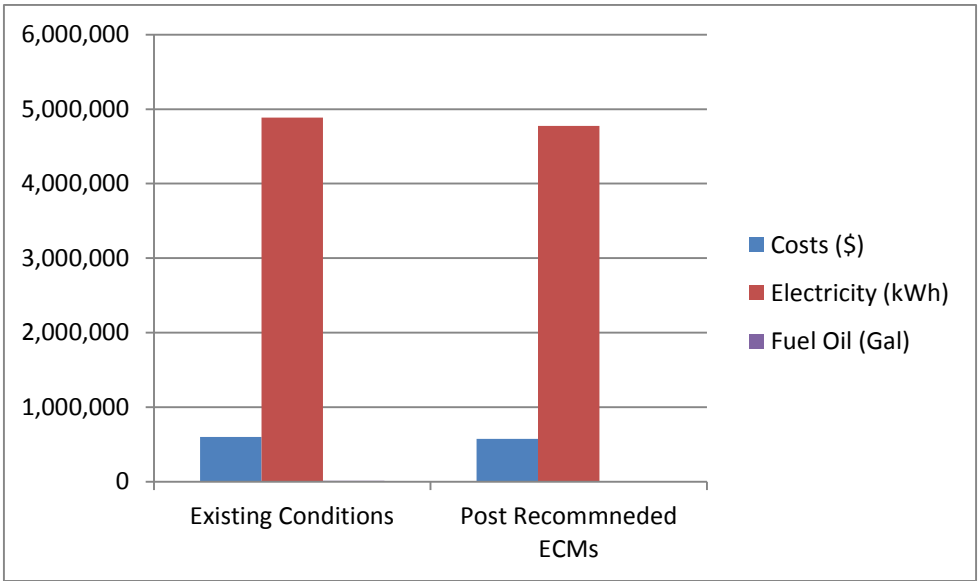
ECM #	Energy Conservation Measure	Est. Costs ($)	Est. Savings ($/year)	Payback w/o Incentive	Potential Incentive ($)*	Payback w/ Incentive	Recommended
ECM-1	Install soft-start on the water supply pump	94,773	6,809	13.9	0	13.9	Y
ECM-2	Replace heating hot water boiler with high efficiency condensing boiler	87,076	4,459	19.5	1,000	19.3	Y
ECM-3	Replace the old furnace with high efficiency condensing furnace	12,117	525	23.1	800	21.6	Y
ECM-4	Replace the old air conditioners	30,600	645	47.4	800	46.2	Y
ECM-5	Replace old plumbing fixtures with low flow plumbing fixtures	30,431	231	131.8	0	131.8	N
ECM-L1	Lighting Replacements with Controls (Occupancy Sensors)	91,333	12,754	7.2	6,020	6.7	Y
Total**		**346,331**	**25,422**	**13.6**	**8,620**	**13.3**	
Total(Recommended)		**315,900**	**25,191**	**12.5**	**8,620**	**12.2**	

* Incentive shown is per the New Jersey SmartStart Program.

By implementing the recommended ECMs, the LIFETIME greenhouse gas (GHG) reduction could result in a total of 47 metric tons.

If the City of East Orange implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommneded ECMs	Percent Savings
Costs ($)	600,002	574,811	4%
Electricity (kWh)	4,886,898	4,774,447	2%
Fuel Oil (Gal)	12,000	9,795	18%
Site EUI (kbtu/SF/Yr)	810.8	792.2	



2.0 BUILDING INFORMATION AND EXISTING CONDITIONS

The following is a summary of the building information related to HVAC, plumbing, building envelope, lighting, kitchen equipment and domestic hot water systems as observed during CHA's site visit. See appendix B for detailed information on mechanical equipment, including capacities, model numbers and age. See appendix F for representative photos of some of the existing conditions observed while onsite.

Building Name: Water Department Pump House
Address: 300 Parsonage Hill Road, Short Hill, NJ, 07078
Gross Floor Area: 20,564
Number of Floors: Two floors
Year Built: 1910

General

Description of Spaces: The Water Department Pump House at 300 Parsonage Hill Road, Short Hill has high lift pump house room, low lift pump house room, generator room, generator room, control office room, conference room and vehicle storage area.
Description of Occupancy: The facility has approximately 8 staff working during the office hours.
Number of Computers: The building has 8 computers.
Building Usage: The facility has three shifts 24/7 to ensure the pumps are running in the right mode.
Construction Materials: the building is constructed with brick with interior drywall finishes.
Roof: The main building has a pitched roof covered with shingles and the vehicle storage area has a flat roof covered with a grey membrane. It is believed that the roofs are well insulated. The roofs appear to be in good condition and therefore no ECMs associated with roof improvements are evaluated.
Windows: The windows are double pane windows with aluminum frames and appear to be in good condition, therefore no ECMs associated with window replacements are evaluated.
Exterior Doors: The building has steel doors with small windows. In discussions with facility staff, these doors are still in good condition. No ECMs associated with improving the exterior doors are evaluated.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating: The building has a fuel oil fired Smith boiler which has a rated energy input of 2,163MBH and energy output of 1,699 MBH which results in a nameplate efficiency of 78.5%. The heating hot water (HHW) provided by this boiler is circulated by two Bell & Gossett pumps to the radiation heaters throughout the building. Each of the pumps is driven by a 1/2HP motor. Apart from the central hot water heating system, there is also a Lennox fuel oil fired furnace which provides heat for the control office and the conference room by using two air handling units in the attic. The name tag of this unit is faded and therefore the capacity and efficiency is unknown. The facility does not have a natural gas supply. The generators operate using diesel fuel to provide emergency power. The boiler and the furnace are not high efficiency heating equipment and both appear to be in poor condition. ECMs related to the boiler and furnace replacements are evaluated.

Cooling: The pump house and vehicle storage areas are not air conditioned. The office and conference room are cooled by the two AHUs in the attic. Each of the AHUs has a split AC unit to provide the cooling: one Trane AC unit has a rated cooling capacity of 7.5 tons and the other has a rated cooling capacity of 5 tons. The AC units were installed around 1997 and are therefore near the end of their useful lifespan. An ECM associated with replacing the two AC units is evaluated.

Ventilation: The pump house and vehicle storage is not mechanically ventilated. The office and conference room area are ventilated by the two AHUs in the attic. The AHUs introduce the minimum amount of fresh air needed. No ECMs associated with the ventilation systems are evaluated.

Exhaust: Both of the buildings have fractional horsepower exhaust fans on the roof serving the restroom and to provide general exhaust. The exhaust fans appear to be in good condition and are controlled, therefore no ECMs associated with exhaust system were evaluated.

Controls Systems

The heating hot water system (Boiler) and the two AHUs are controlled by manual thermostats. Based on the thermostat settings, the temperature setting is typically set to be relatively low and the fan speed is set at low speed too. Therefore, no ECMs related to the control were evaluated.

Domestic Hot Water Systems

The building has an electric DHW heater located in the pump house serving toilet room lavatories. The heater has a rated capacity of 4.5kW. There is also an abandoned DHW heater that once served the shower area however, the facility is not using it anymore. As the domestic hot water load is relatively small and natural gas is not available at this building, we have not evaluated any ECMs associated with converting the domestic hot water heater.

Water Pumping Equipment

This water pump house has two types of pumps: low lift pumps and high lift pumps. The high lift pumps have higher pressure and supply water to the areas over the hills; the low lift pumps have lower pressure compared with high lift pumps and supply water to the areas nearby. There are five low lift pumps and 2 high lift pumps. The details of them are shown below:

Name	Brand	Capacity	Function
Low Lift Pump#5	Siemens	600HP	
Low Lift Pump#1	GE	450HP	Backup for Pump#5
Low Lift Pump#4	Allis-Chalmeers	250HP	
Low Lift Pump#3	Allis-Chalmeers	150HP	Backup
Low Lift Pump#2	N/A	N/A	Out of Service
High Lift Pump#6	Siemens	300HP	
High Lift Pump#7	Siemens	100HP	Backup for Pump#6

Apart from the water pumps, there are also chlorinator pumps, vacuum pumps, and air compressors to help support the water circulation system and the backup generator system.

Kitchen Equipment

The building does not have a kitchen.

Plug Load

This building has only a few computers, printers, a microwave and a residential refrigerator which contribute to the plug load. As the plug load is a relatively small portion of the total electrical load, no ECMs are recommend, however we have included and O & M measure to replace the small appliances with Energy Star rated appliances when the old ones reach the end of their useful life span.

Plumbing Systems

The plumbing fixtures are old and appear to be in poor condition, therefore an ECM associated with upgrading the plumbing fixtures with low flow plumbing fixtures is recommended.

Lighting Systems

This building has 40W T-12 fluorescent lighting, incandescent lights and metal halide pole lights. There are ten (10) 400W exterior metal halides, eleven (11) 175W metal halides and three (3) incandescent lights providing outdoor lighting. All of the interior lights are controlled by manual switches. An ECM is included that evaluated the savings potential for replacing all of the lighting with LED equivalents and controlling the new lights using occupancy sensors.

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3.0 UTILITIES

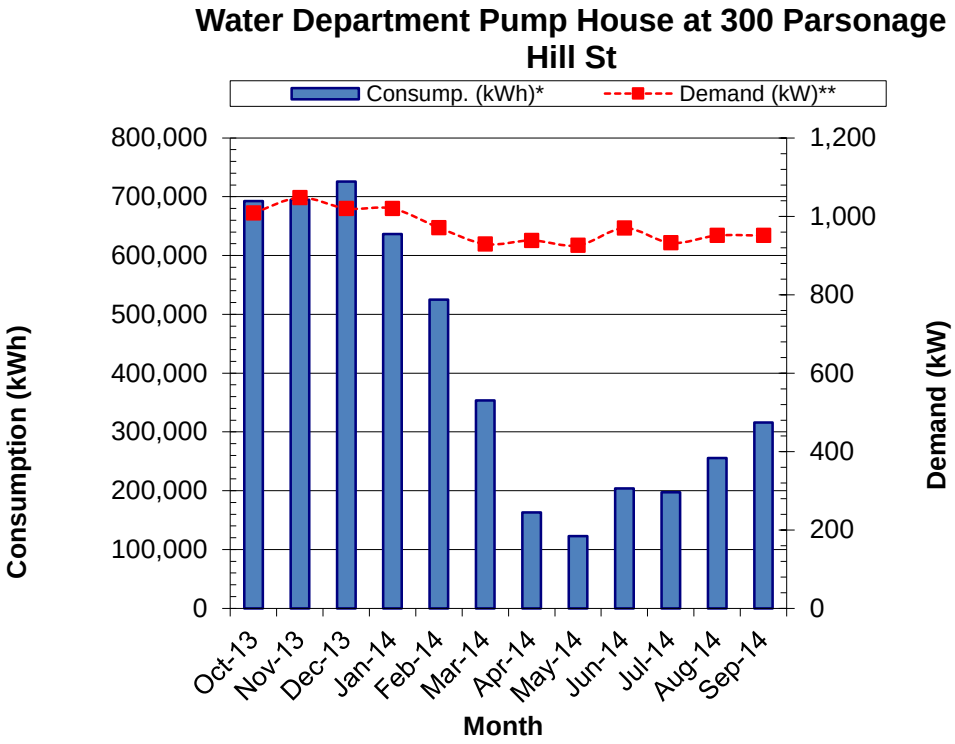
Natural gas, electricity and water are separately metered into this building. Utilities used by the building are delivered and supplied by the following utility companies:

	Electric	Fuel Oil	Diesel
Deliverer	PSE&G	Finch Fuel	Finch Fuel
Supplier	PSE&G	Finch Fuel	Finch Fuel

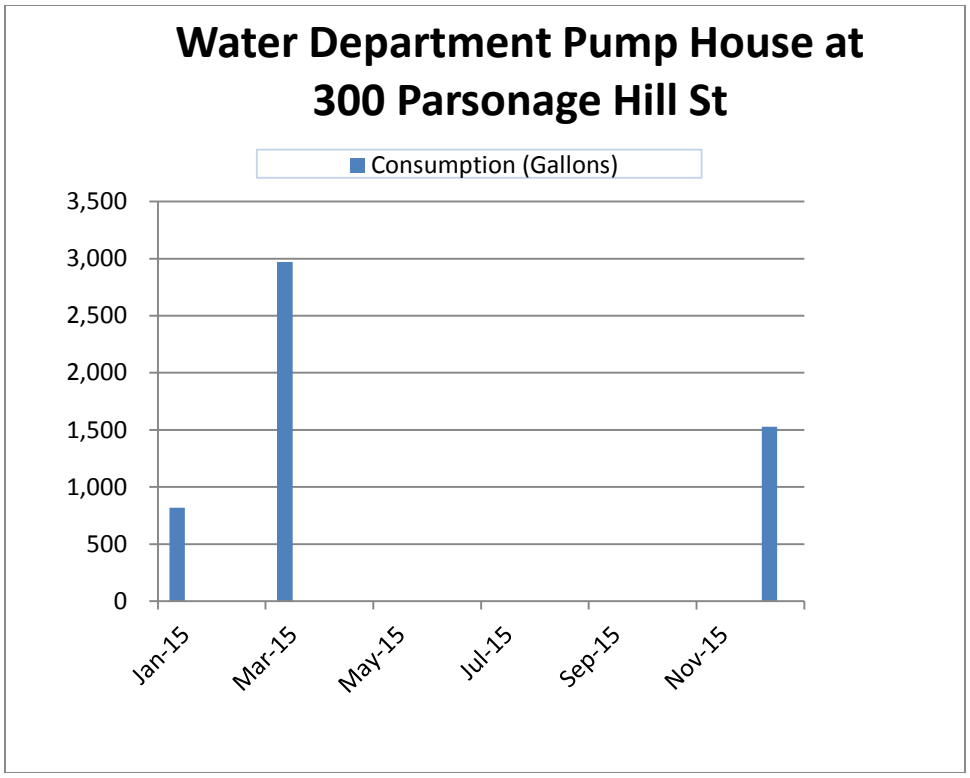
For the 12-month period ending in September 2014, the utilities usages and costs for the building were as follows:

Electric		
Annual Usage	4,886,898	kWh/yr
Annual Cost	599,651	$
Blended Rate	0.123	$/kWh
Peak Demand	1,019.9	kW
Min. Demand	926.1	kW
Avg. Demand	972.3	kW
Fuel Oil#2		
Annual Usage	5,318	Gallons/yr
Annual Cost	8,707	$
Rate	1.637	$/Gallon
Diesel		
Annual Usage	15,629	Gallons/yr
Annual Cost	28,538	$
Rate	1.826	$/Gallon
Energy Summary		
Building Area	20,564	SF
Energy Usage Intensity (EUI)	952	KBtu/SF/yr
Energy Cost Index (ECI)	30.97	$/SF/yr
Total Annual Utility Costs	636,897	$

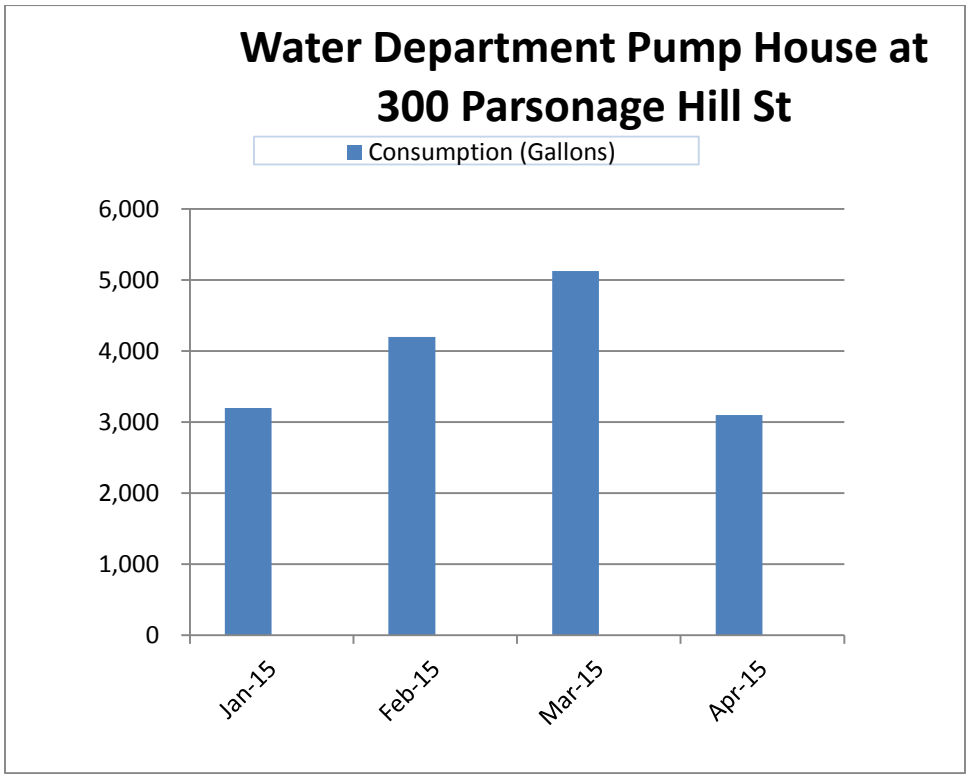
Blended Rate: Average rate charged determined by the annual cost / annual usage
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)
Demand Rate: Rate charged for actual electrical demand in kW (based on most recent electric bill)
*Some months that do not have utility data and the missing demand usage are estimated and highlighted in the utility spreadsheet



The electric usage varies along with the water pump usage, the frequency of the generators are turned on and the rest of the pump house accessories. We can see that there are more water demand in winter seasons than summer season for 2014 in this pump house.



The fuel oil usage in this building is used for heating only and is correlated to the heating load of the building. There are no meters available to show the actual heating oil usage.



The diesel usage in this building is used for the emergency power generators only and is correlated to how frequently the facility run the generators.

See Appendix A for utility analysis.

Under New Jersey's energy deregulation law, the supply portion of the electric (or natural gas) bill is separated from the delivery portion. The supply portion is open to competition, and customers can shop around for the best price for their energy suppliers. The electric and natural gas distribution utilities will still deliver the gas/electric supplies through their wires and pipes and respond to emergencies, should they arise regardless of where those supplies are purchased. Purchasing the energy supplies from a company other than your electric or gas utility is purely an economic decision; it has no impact on the reliability or safety of the service.

Comparison of Utility Rates to NJ State Average Rates*				Recommended to Shop for Third Party Supplier?
Utility	Units	Pump Station Average Rate	NJ Average Rate	
Electricity	$/kWh	$0.123	$0.13	N
Natural Gas	$/Therm	N/A	$0.96	N/A

* Per U.S. Energy Information Administration (2013 data – Electricity and Natural Gas, 2012 data – Fuel Oil)

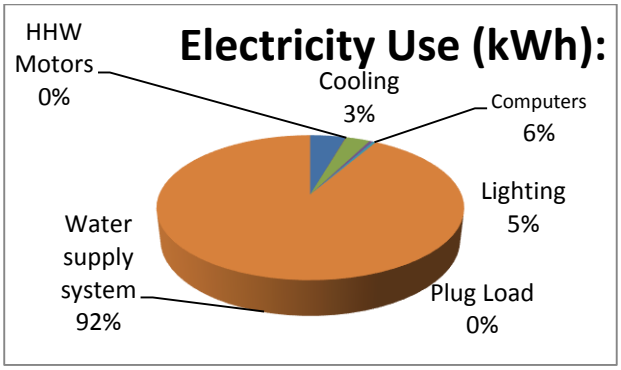
Additional information on selecting a third party energy supplier is available here:

http://www.state.nj.us/bpu/commercial/shopping.html.

See Appendix A for a list of third-party energy suppliers licensed by the Board of Public Utilities to sell within the building's service area.

The charts below represent estimated utility end-use utility profiles for the building. The values used within the charts were estimated from a review of the utility analysis and the energy savings calculations.

Site End-Use Utility Profile



4.0 BENCHMARKING

The EPA Portfolio Manager benchmarking tool provides a site and source Energy Use Intensity (EUI), as well as, an Energy Star performance rating for qualifying building types. The EUIs are provided in kBtu/ft2/year, and the performance rating represents how energy efficient a building is on a scale of 1 to 100; with 100 being the most efficient. In order for a building to receive an Energy Star label, the energy benchmark rating must be at least 75. As energy use decreases from implementation of the proposed measures, the Energy Star rating will increase. However, the EPA does not have scores for all buildings types. The buildings that do not have energy ratings now are compared with national median EUI.

The sites EUI is the amount of heat and electricity consumed by a building as reflected in its utility bills. Site energy may be delivered to a facility in the form of primary energy, which is raw fuel burned to create heat or electricity; such as natural gas or oil; or as secondary energy, which is the product created from a raw fuel such as electricity or district steam. To provide an equitable comparison for different buildings with varying proportions of primary and secondary energy consumption, Portfolio Manager uses the convention of source EUIs. The source energy also accounts for losses incurred in production, storage, transmission, and delivery of energy to the site; which provides an equivalent measure for various types of buildings with differing energy sources. The results of the benchmarking is contained in the table below. Copies of the benchmarking report are available in Appendix F.

Site EUI kBtu/ft^2/yr	Source EUI (kBtu/ft^2/yr)	Energy Star Rating (1-100)
951.4	2,688	N/A

The national median site EUI is 910.4 kBtu/ft2/yr and source EUI is 2,572.2 kBtu/ft2/yr. The building has 14% higher than the national median source EUI. It is expected that the EUI will be reduced by implementing the measures discussed in this report.

[redacted]

5.0 ENERGY CONSERVATION MEASURES

The following types of energy savings opportunities are identified in this section of the report:

- Energy conservation measures (ECMs) are energy savings recommendations that typically require a financial investment. For these areas of opportunity, CHA prepared detailed calculations, as summarized in this section and in Appendix C. In general, additional savings may exist from reductions in maintenance activities associated with new equipment or better controls; however, for conservatism, maintenance savings are not accounted for in this report; instead the only savings which are reported are those derived directly from reductions in energy which can be tracked by the utility bills.

- Operational and Maintenance measures (O&M) consist of low-cost or no-cost operational opportunities, which if implemented would have positive impacts on overall building operation, comfort levels, and/or energy usage. There are no estimated savings, costs or paybacks associated with the O&M measures included as part of this study.

Energy savings were quantified in the form of:

- Electrical usage (kWh=Kilowatt-hour),
- Electrical demand (kW=kilowatts),
- Natural gas (therms=100,000 Btu),
- Propane gas (gallons=91,650 Btu),
- Fuel oil (gallons =138,700 Btu), and
- Water (kgal=1,000 gallons).

These recommendations are influenced by the time period that it takes for a proposed project to “break even” referred to as “Simple Payback”. Simple payback is calculated by dividing the estimated cost of implementing the ECM by the energy cost savings (in dollars) of that ECM.

Another financial indicator of the performance of a particular ECM is the Return on Investment (ROI), which represents the benefit (annual savings over the life of a project) of an investment divided by the cost of the investment. The result is expressed as a percentage or ratio.

Two other financial analyses included in this report are Internal Rate of Return (IRR) and Net Present Value (NPV). Internal Rate of Return is the discount rate at which the present value of a project costs equals the present value of the project savings. Net Present Value is the difference between present value of an investment’s future net cash flows and the initial investment. If the NPV equals “0”, the project would equate to investing the same amount of dollars at the desired rate. NPV is sometimes referred to as Net Present Worth. These values are provided in the Summary Tab in Appendix C.

5.1 ECM-1 Install Soft-start on the Water Supply Pumps

This pump house has many large capacity water pump motors ranging from 100HP to 600HP. In discussions with the facility staff, it was noted that there are frequent power outage due to weather or unexpected occasions. The pumps have to be re-started after the power outage which creates large peak electric demand due to the size of the pumps. Installing soft-start will help reduce the peak demand. It is estimated that there are 10% peak demand reduction when the soft-starts were installed.

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

ECM-1 Install Soft-start on the Water Supply Pumps

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
94,773	71	0	0	6,809	1.5	0	13.9	13.9

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is recommended.

5.2 ECM-2 Replace the Boiler with a Condensing Boiler

The building has a fuel oil fired Smith boiler which has a rated energy input of 2,163MBH and energy output of 1,699 MBH which results in a nameplate efficiency of 78.5%. There are high efficiency condensing boilers available that have better efficiencies, therefore, it is suggested one condensing boiler be added. New modulating condensing gas boilers are available that minimally operate at 88%, and can operate as high as 96%.

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

ECM-2 Replace the Boiler with a Condensing Boiler

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
87,076	0	0	0	4,459	(1.0)	1,000	19.5	19.3

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is recommended.

5.3 ECM-3 Replace the furnace with high efficiency condensing furnace

There is a Lennox fuel oil fired furnace which provide heat for the control office and the conference room by using two air handling units in the attic. The name tag of this unit is faded and therefore the capacity and efficiency is unknown. It is estimated that the furnace has an approximately 200MBH energy input and 78% efficiency There are high efficiency

condensing furnaces available that have better efficiencies, therefore, it is suggested one condensing furnace be added. New modulating condensing gas furnaces are available that minimally operate at 88%, and can operate as high as 96%. It is suggested that City of East Orange find out the natural gas supply gas pressure to this building and see if there are any condensing furnaces viable to run at the natural gas supply pressure.

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

ECM-3 Replace the old furnace with high efficiency condensing furnace

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
12,117	0	0	0	525	(1.0)	800	23.1	21.6

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is recommended.

5.4 ECM-4 Replace the Split Air Conditioning Systems

The office and conference room are cooled by two ducted AHUs in the attic. Each of the AHUs has a split AC unit to provide the cooling: one Trane AC unit has a rated cooling capacity of 7.5 ton and the other has a rated cooling capacity of 5 ton. The AC units were installed around 1997 and is near the end of their useful lifespan. It is estimated that the existing AC units have EER of 11. There are AC units in the market have EER of 15 or higher. It is suggested that new high EER AC units be installed to replace these existing units.

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

ECM-4 Replace the old air conditioners

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
30,600	2	4,113	0	645	(0.5)	800	47.4	46.2

* Incentive shown is per the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities.

This measure is recommended.

5.5 ECM-5 Upgrade the Plumbing Fixtures with Low Flow Fixtures

This building contains older style high flow water toilets (3.5 GPF), urinals (1.5 GPF), and high flow faucets (2.0 GPM). Waterless urinals and low-flow toilets/faucets are recommended to replace the existing plumbing fixtures.

The water savings associated from replacing existing high flow fixtures with low-flow/no-flow fixtures was calculated by taking the difference of the annual water usage for the proposed and base case. The basis of this calculation is the estimate usage of each fixture, gallons per use, and number of fixtures. Replacing the existing fixtures in the restrooms with 1.28 Gals/flush toilets, waterless urinals, and 0.5 gpm faucets will conserve water which will result in lower annual water and sewer charges. Faucets with low-flow push valves were not considered for replacement.

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

ECM-5 Upgrade the Plumbing Fixtures with Low Flow Fixtures

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Natural Gas	Total				
$	kGal	Therms	$		$	Years	Years
30,431	38	0	231	(0.9)	0	131.8	131.8

* Does not qualify for Incentive from the New Jersey SmartStart Program. See section 6.0 for other incentive opportunities

This measure is not recommended due to long payback period, however if plumbing modifications are planned for the future, low flow plumbing fixtures should be considered.

5.6 ECM-L1 Lighting Replacements with Controls (Occupancy Sensors)

This building has 40W T-12 fluorescent lighting, incandescent lights and metal halide pole lights. There are about ten 400W exterior metal halides, eleven 175W metal halides and three incandescent lights used as outdoor lighting. All of the interior lights are controlled by manual switches. The review of the comprehensive lighting survey determined that lighting in some areas could benefit from installation of occupancy sensors to turn off lights when they are unoccupied. This measure looks at replacing the lights with LED and installing occupancy sensors.

Overall energy consumption can be reduced by replacing inefficient bulbs and linear fluorescent bulbs with more efficient LED technology. To compute the annual savings for this ECM, the energy consumption of the current lighting fixtures was established and compared to the proposed fixture power requirement with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. These calculations are based on 1 to 1 replacements of the fixtures, and do not take into account lumen output requirements for a given space. A more comprehensive engineering study should be performed to determine correct lighting levels.

Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix C and summarized below:

ECM-L1 Lighting Replacements with Controls (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
91,333	20	108,338	0	12,754	0.6	6,020	7.2	6.7

* LED new fixtures are still qualified for prescribed incentives, however, LED retrofits must go through the custom incentive which is not calculated in LGEA study therefore, the potential incentive shown in the table is the possible prescribed incentive.

This measure is recommended.

5.7 Additional O&M Opportunities

This list of operations and maintenance (O&M) type measures represent low-cost or no-cost opportunities; which if implemented will have a positive impact on the overall building operations, comfort, and/or energy consumption. The recommended O&M measures for this building are as follows:

- Purchase ENERGY STAR® appliances when needed

6.0 PROJECT INCENTIVES

6.1 Incentives Overview

The following sections give detailed information on available incentive programs including New Jersey Smart Start, Direct Install, New Jersey Pay for Performance (P4P) and Energy Savings Improvement Plan (ESIP). If the school district wishes to and is eligible to participate in the Energy Savings Improvement Plan (ESIP) program and/or the Pay for Performance Incentive Program (P4P), it cannot participate in either the Smart Start or Direct Install Programs.

Web URL: http://www.njcleanenergy.com/commercial-industrial/home/home/

6.1.1 New Jersey Smart Start Program

For this energy audit, The New Jersey Smart Start Incentives are used in the energy savings calculations, where applicable. This program is intended for medium and large energy users and provides incentives for:

- Electric Chillers
- Gas Chillers
- Gas Heating
- Unitary HVAC
- Ground Source Heat Pumps
- Variable Frequency Drives/Motors
- Refrigeration
- Prescriptive and Performance Lighting and Lighting Controls

The equipment is procured using a typical bid-build method. It is then installed, paid for and then the incentives are reimbursed to the owner.

6.1.2 Direct Install Program

The Direct Install Program applies to smaller facilities that have a peak electrical demand of 200 kW or less in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric utility companies.

Direct Install was funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 70% of the costs for lighting, HVAC, motors, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can reduce the implementation cost of energy conservation projects.

The Direct Install program has specific HVAC equipment and lighting requirements and is generally applicable only to smaller package HVAC units, small boilers and lighting retrofits.

The program pays a maximum amount of $75,000 per building, and up to $250,000 per customer per year. Installations must be completed by an approved Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this energy audit. The incentive is reimbursed to the owner upon successful replacement and payment of the equipment.

The building does not qualify for this program due to the high monthly demand.

6.1.3 New Jersey Pay For Performance Program (P4P)

This building may be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives are available from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed to offset the cost of energy conservation projects for facilities that pay the Societal Benefits Charge (SBC) and whose demand (kW) in any of the preceding 12 months exceeds 200 kW. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). Additionally, the overall return on investment (ROI) must exceed 10%. If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The ERP must include a detailed energy audit of the desired ECMs, energy savings calculations (using building modeling software) and inputting of all utility bills into the EPA Portfolio Manager website.

- Incentive Amount: $0.10/SF
- Minimum incentive: $5,000
- Maximum Incentive: $50,000 or 50% of Facility annual energy cost

The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above. The ERP must be completed by a Certified Energy Manager (CEM) and submitted along with the project application.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy savings as determined in Incentive #1 (Minimum 15% savings must be achieved), and is paid upon successful installation of recommended measures.

<u>Electric</u>

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.

- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Incentive cap: 25% of total project cost

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool.

Electric

- Base incentive based on 15% savings: $0.09/ per projected kWh saved.
- For each % over 15% add: $0.005 per projected kWh saved.
- Maximum incentive: $0.11/ kWh per projected kWh saved.

Gas

- Base incentive based on 15% savings: $0.90/ per projected Therm saved.
- For each % over 15% add: $0.05 per projected Therm saved.
- Maximum incentive: $1.25 per projected Therm saved.

Combining Incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

For the purpose of demonstrating the eligibility of the ECM's to meet the minimum savings requirement of 15% annual savings and 10% ROI for the Pay for Performance Program, all ECM's identified in this report have been included in the incentive calculations. The results for the building are shown in Appendix C.

We estimate the total source energy savings for the recommended package of measures to be 2.3%. The overall internal rate of return is estimated to be 6.1%.

Based on these preliminary estimates, this project likely would not meet the minimum requirements to be eligible for the Pay for Performance program.

6.1.4 Energy Savings Improvement Plan

The Energy Savings Improvement Program (ESIP) allows government agencies to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. Under the recently enacted Chapter 4 of the Laws of 2009 (the law), the ESIP provides all government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources.

ESIP allows local units to use “energy savings obligations” (ESO) to pay for the capital costs of energy improvements to their facilities. ESIP loans have a maximum loan term of 15 year. ESOs are not considered “new general obligation debt” of a local unit and do not count against debt limits or require voter approval. They may be issued as refunding bonds or leases. Savings generated from the installation of energy conservation measures pay the principal of and interest on the bonds; for that reason, the debt service created by the ESOs is not paid from the debt service fund, but is paid from the general fund.

For local governments interested in pursuing an ESIP, the first step is to perform an energy audit. Pursuing a Local Government Energy Audit through New Jersey's Clean Energy Program is a valuable first step to the ESIP approach. The “Local Finance Notice” outlines how local governments can develop and implement an ESIP for their facilities. The ESIP can be prepared internally if the entity has qualified staff. If not, the ESIP must be implemented by an independent contractor and not by the energy savings company producing the Energy Reduction Plan.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Local units should carefully consider all alternatives to develop an approach that best meets their needs.

6.1.5 Renewable Energy Incentive Program

The Renewable Energy Incentive Program (REIP) is part of New Jersey's efforts to reach its Energy Master Plan goals of striving to use 30 percent of electricity from renewable sources by 2020.

Incentives for sustainable bio-power projects and for energy storage projects are currently under development, with competitive solicitations for each of those technologies expected to begin in the first quarter of 2014. The wind program is currently on hold.

New solar projects are no longer eligible for REIP incentives, but can register for Solar Renewable Energy Certificates (SRECs) through the SREC Registration Program (SRP).

7.0 ALTERNATIVE ENERGY SCREENING EVALUATION

7.1 Solar

7.1.1 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 amount of available roof area determines how large of a solar array can be installed on any given roof. The table below summarizes the approximate roof area available on the building and the associated solar array size that can be installed.

Available Roof Area (Ft^2)	Potential PV Array Size (kW)
10,613	85

The PVWATTS solar power generation model was utilized to calculate PV power generation; this model is provided in Appendix D.

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. Payments that will be received by the PV producer will change from year to year dependent upon supply and demand. There is no definitive way to calculate an exact price that will be received by the PV producer for SREC credits over the next 15 years. Renewable Energy Consultants estimates an average of $204/SREC for January 2016 and this number was utilized in the cash flow for this report.

The system costs for PV installations were derived from recent solar contractor budgetary pricing in the state of New Jersey and include the total cost of the system installation (PV panels, inverters, wiring, ballast, controls). The cost of installation is currently about $4.00 per watt or $4,000 per kW of installed system, for a typical system. There are other considerations that have not been included in this pricing, such as the condition of the roof and need for structural reinforcement. Photovoltaic systems can be ground mounted if the roof is not suitable, however, this installation requires a substantial amount of open property (not wooded) and underground wiring, which adds more cost. 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 most likely need to be replaced during the useful life of the PV system.

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

Photovoltaic (PV) Rooftop Solar Power Generation –85 kW System

Budgetary Cost	Annual Utility Savings			Total Savings	New Jersey Renewable SREC	Payback (without SREC)	Payback (with SREC)	Recommended
	Electricity		Natural Gas					
$	kW	kWh	Therms	$	$	Years	Years	Y/N
$339,623	85	102,744	0	$13,459	$25,686	25.2	8.7	FS

Note: CHA typically recommends a more detailed evaluation be conducted for the installation of PV Solar arrays when the screening evaluation shows a payback of less than 20 years. Therefore, this ECM is recommended for further study. Before implementation is pursued, the township should consult with a certified solar PV contractor.

7.1.2 Solar Thermal Hot Water Generation

Active solar thermal systems use solar collectors to gather the sun's energy to heat a fluid. An absorber in the collector (usually black colored piping) converts the sun's energy into heat. The heat is transferred to circulating water, antifreeze, or air for immediate use or is storage for later utilization. Applications for active solar thermal energy include supplementing domestic hot water, heating swimming pools, space heating or 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 at the same angle as the site's latitude, to maximize the amount of solar radiation collected on a yearly basis.

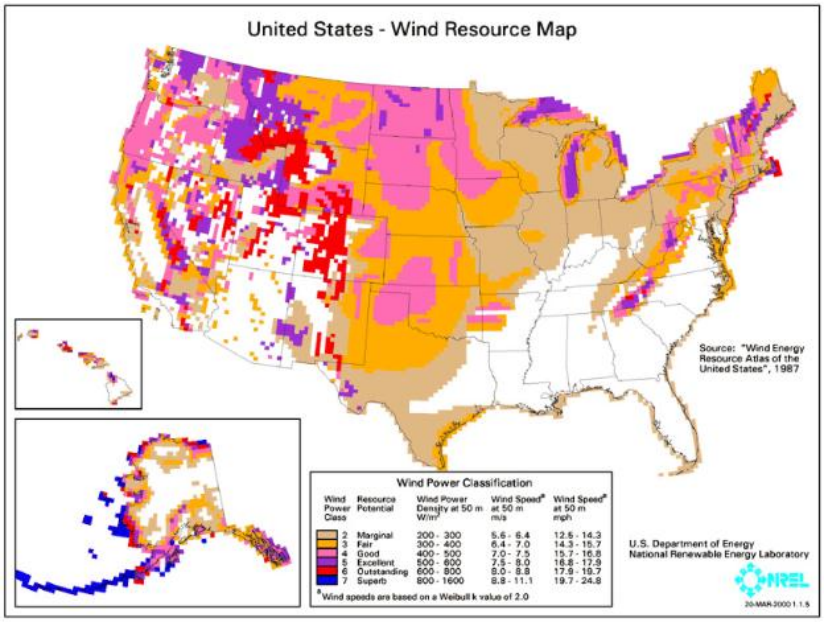
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). The most practical system would transfer the heat from the panels to thermal storage tanks and then use the pre-heated water for domestic hot water production. DHW is presently produced by natural gas fired water heaters and, therefore, this measure would offer natural gas utility savings. Unfortunately, the amount of domestic hot water that is currently used by this building is very small. Installing a solar domestic hot water system is not recommended due to the limited amount of domestic hot water presently consumed by the building.

This measure is not recommended due to the relatively low domestic hot water usage.

7.2 Wind Powered Turbines

Wind power is the conversion of kinetic energy from wind into mechanical power that is used to drive a generator which creates electricity by means of a wind turbine. A wind turbine consists of rotor and blades connected to a gearbox and generator that are

mounted onto a tower. Newer wind turbines also use advanced technology to generate electricity at a variety of frequencies depending on the wind speed, convert it to DC and then back to AC before sending it to the grid. Wind turbines range from 50 – 750 kW for utility scale turbines down to below 50 kW for residential use. On a scale of 1 (the lowest) to 7 (the highest), Class 3 and above (wind speeds of 13 mph or greater) are generally considered "good wind resource" according to the Wind Energy Development Programmatic EIS Information Center hosted by the Bureau of Land Management. According to the map below, published by NREL, Newark, NJ is classified as Class 1 at 50m, meaning the city would not be a good candidate for wind power.



This measure is not recommended due to the location of the building.

7.3 Combined Heat and Power Plant

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

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. This building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter; however thermal usage during the summer months does not exist. Thermal energy produced by the CHP plant in

the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. CHP is not recommended due to the building's limited summer thermal demand.

This measure is not recommended due to the absence of year-round thermal loads which are needed for efficiency CHP operation. However, a mini-size CHP could be an option for the facility to consider. The sizing and energy savings of the mini-size CHP require further study.

7.4 Demand Response Curtailment

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

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

A pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. From October 2014 through September 2014 the following table summarizes the electricity load profile for the building.

Building Electric Load Profile

Peak Demand kW	Min Demand kW	Avg Demand kW	Onsite Generation Y/N	Eligible? Y/N
1,019.9	926.1	972.3	N	N

*the demand is estimated from one month bill

This measure is not recommended due to not the special requirements of the pump house which require the water pumps to run 24/7 and with an emergency generator.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following section summarizes the LGEA energy audit conducted by CHA for City of East Orange.

The following projects should be considered for implementation:

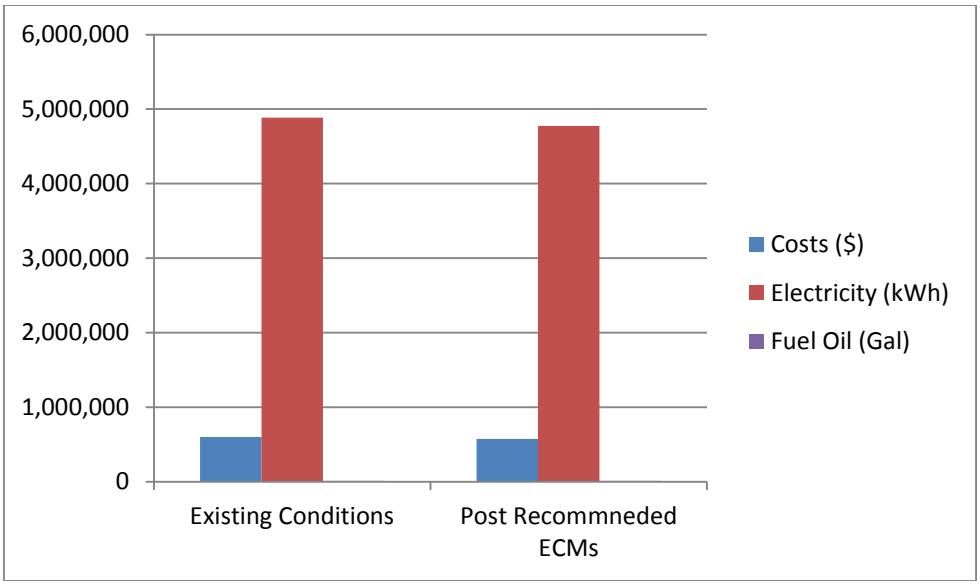
- Install soft-start on the water supply pump
- Replace heating hot water boiler with high efficiency condensing boiler
- Replace the old furnace with high efficiency condensing furnace
- Replace the old air conditioners
- Lighting Replacements with LED and add Controls (Occupancy Sensors)

The potential annual energy and cost savings for the recommended ECMs are shown in the following table.

Electric Savings (kWh)	Fuel Oil Savings (gallons)	Total Savings ($)	Payback (years)
112,451	2,205	25,191	12.5

If the city implements the recommended ECMs, energy savings would be as follows:

	Existing Conditions	Post Recommneded ECMs	Percent Savings
Costs ($)	600,002	574,811	4%
Electricity (kWh)	4,886,898	4,774,447	2%
Fuel Oil (Gal)	12,000	9,795	18%
Site EUI (kbtu/SF/Yr)	810.8	792.2	



Next Steps: This energy audit has identified several areas of potential energy savings. City of East Orange can use this information to pursue incentives offered by the NJBPU's NJ Clean Energy Program. Additional meetings will be scheduled with city staff members to review possible options.

APPENDIX A

Utility Usage Analysis and Alternate Utility Suppliers

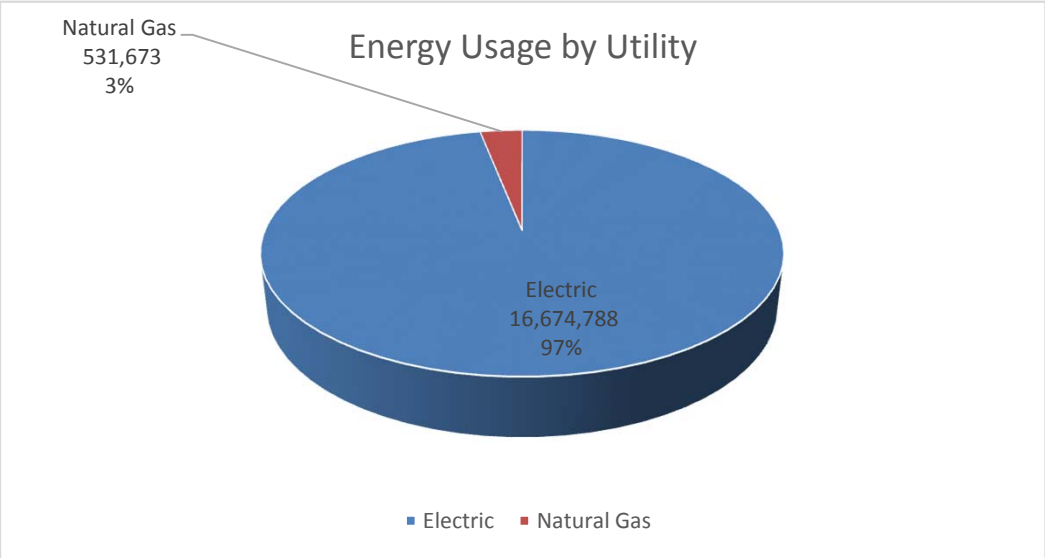
East Orange NJBPU LGEA
Water Department Pump House at 300 Parsonage Hill St

Annual Utilities

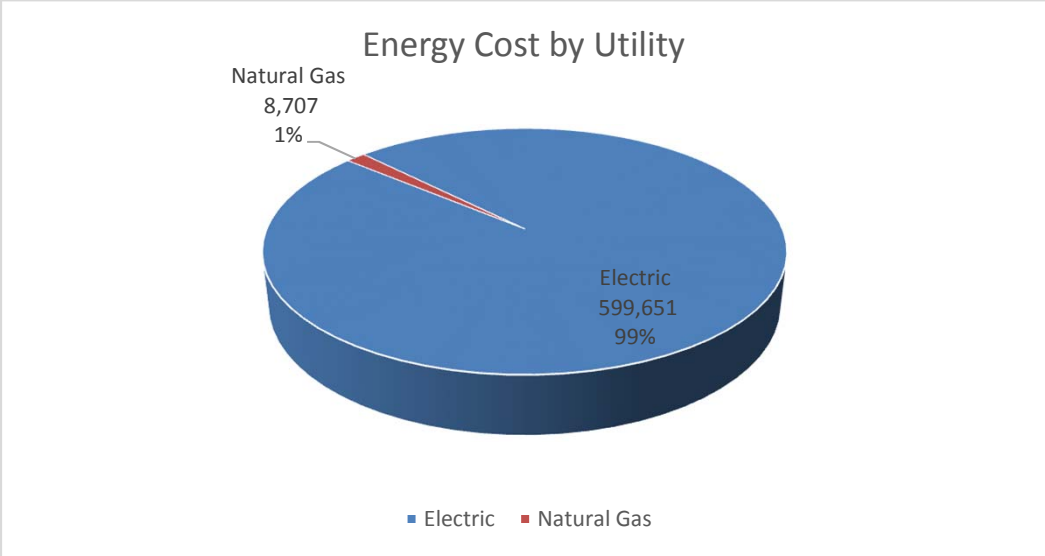
12-month Summary

Electric		
Annual Usage	4,886,898	kWh/yr
Annual Cost	599,651	$
Blended Rate	0.123	$/kWh
Peak Demand	1,019.9	kW
Min. Demand	926.1	kW
Avg. Demand	972.3	kW
Fuel Oil for Heating		
Annual Usage	5,318	Gallon/yr
Annual Cost	8,707	$
Rate	1.637	$/Gallon
Energy Summary		
Building Area	42,932	SF
Energy Usage Intensity (EUI)	401	KBtu/SF/yr
Energy Cost Index (ECI)	14.17	$/SF/yr
Total Annual Utility Costs	608,358	$

Utility	KBtu	%
Electric	16,674,788	97%
Natural Gas	531,673	3%
	17,206,461	100%



Utility	$	%
Electric	599,651	99%
Natural Gas	8,707	1%
	608,358	100%



East Orange NJBPU LGEA
Water Department Pump House at 300 Parsonage Hill St

Electric Service

Account No.: **100004101612** **Delivery: PSE&G**
Meter No.: **S312720199** **Rate Rate JC_GT__01F**

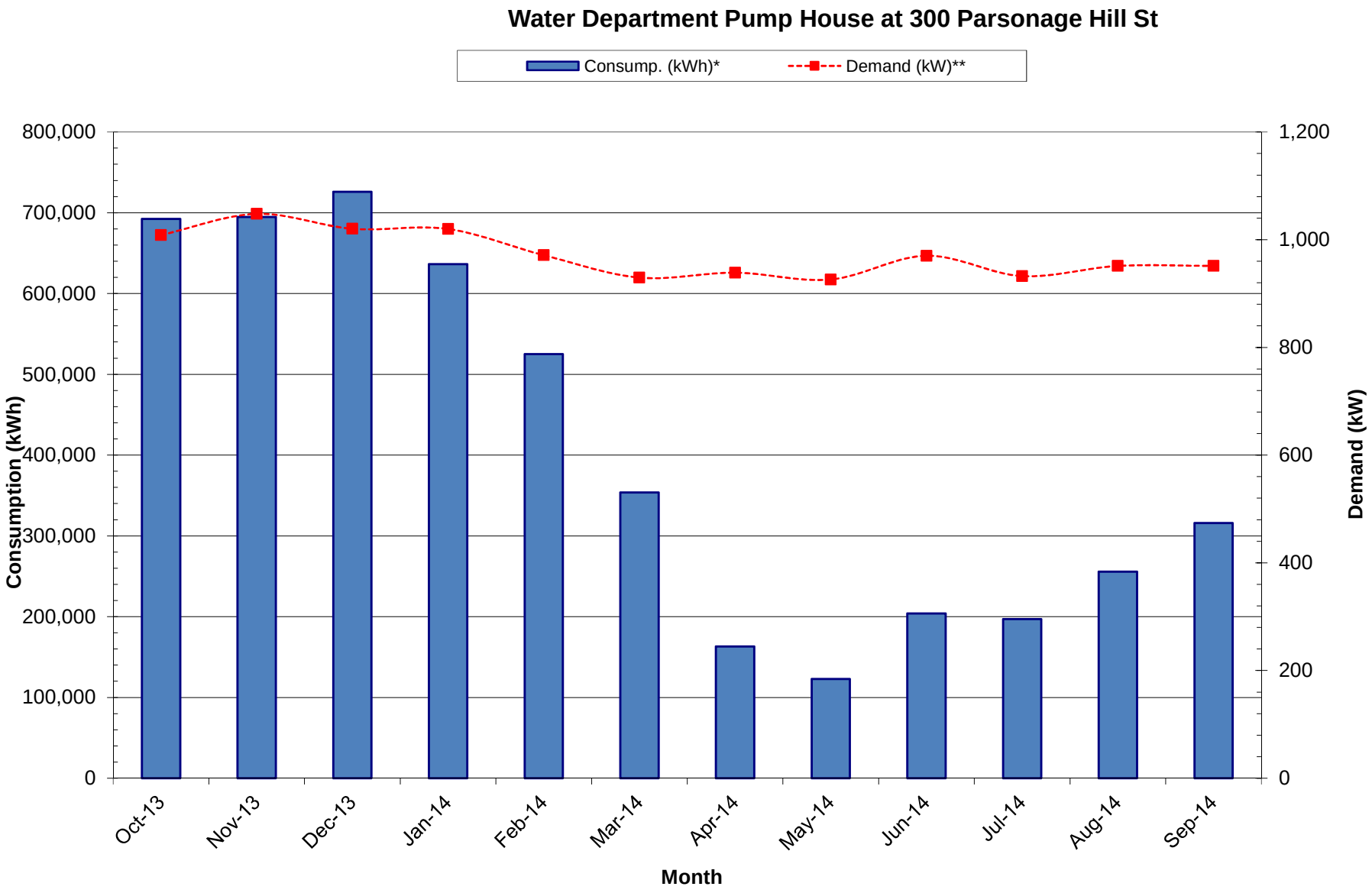
			Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs				
Month	**Consump. (kWh)***	**Demand (kW)****	**Delivery ($)***	**Supplier ($)**	**Total ($)**	**Consumption ($)**	**Demand ($)**	**Delivery ($/kWh)**	**Supplier ($/kWh)**	**Consumption Rate ($/kWh)**	**Demand ($/kW)**	**Blended Rate ($/kWh)**
October-13	692,461	1,009	27,698	34,744.34	62,442.78	54373.18	8069.60	0.040	0.050	0.079	8.000	0.090
November-13	694,751	1,048	27,790	73,518.80	101,308.84	92925.64	8383.20	0.040	0.106	0.134	8.000	0.146
December-13	725,970	1,020	29,039	92,489.14	121,527.94	113366.34	8161.60	0.040	0.127	0.156	8.000	0.167
January-14	636,364	1,020	25,455	72,606.92	98,061.48	89902.28	8159.20	0.040	0.114	0.141	8.000	0.154
February-14	524,901	971	20,996	38,391.17	59,387.21	51617.61	7769.60	0.040	0.073	0.098	8.000	0.113
March-14	353,643	930	14,146	22,160.80	36,306.52	28869.72	7436.80	0.040	0.063	0.082	8.000	0.103
April-14	163,020	939	6,521	13,097.08	19,617.88	12108.28	7509.60	0.040	0.080	0.074	8.000	0.120
May-14	122,903	926	4,916	13,120.79	18,036.91	10628.11	7408.80	0.040	0.107	0.086	8.000	0.147
June-14	204,019	970	8,161	12,300.11	20,460.87	12699.27	7761.60	0.040	0.060	0.062	8.000	0.100
July-14	197,134	932	7,885	11,219.09	19,104.45	11645.25	7459.20	0.040	0.057	0.059	8.000	0.097
August-14	255,668	951	10,227	10,591.69	20,818.41	13208.01	7610.40	0.040	0.041	0.052	8.000	0.081
September-14	316,064	951	12,643	9,935.52	22,578.08	14967.68	7610.40	0.040	0.031	0.047	8.000	0.071
Total (All)	**4,886,898**	**1,047.90**	**$195,475.92**	**$404,175.45**	**$599,651.37**	**$506,311.37**	**$93,340.00**	**$0.04**	**$0.08**	**$0.10**	**$8.00**	**$0.12**
Notes	1	2	3	4	5			6	7			8

1.) Number of kWh of electric energy used per month
2.) Number of kW of power measured
3.) Electric charges from Delivery provider
4.) Electric charges from Supply provider - note, includes 8.875% tax
5.) Total charges (Delivery + Supplier)
6.) Delivery Charges ($) / Consumption (kWh)
7.) Supplier Charges ($) / Consumption (kWh)
8.) Total Charges ($) / Consumption (kWh)

* Based on combined numbers provided by client
** Addition of two accounts provided by client

1,047.9 Max
926.1 Min
972.3 average

600

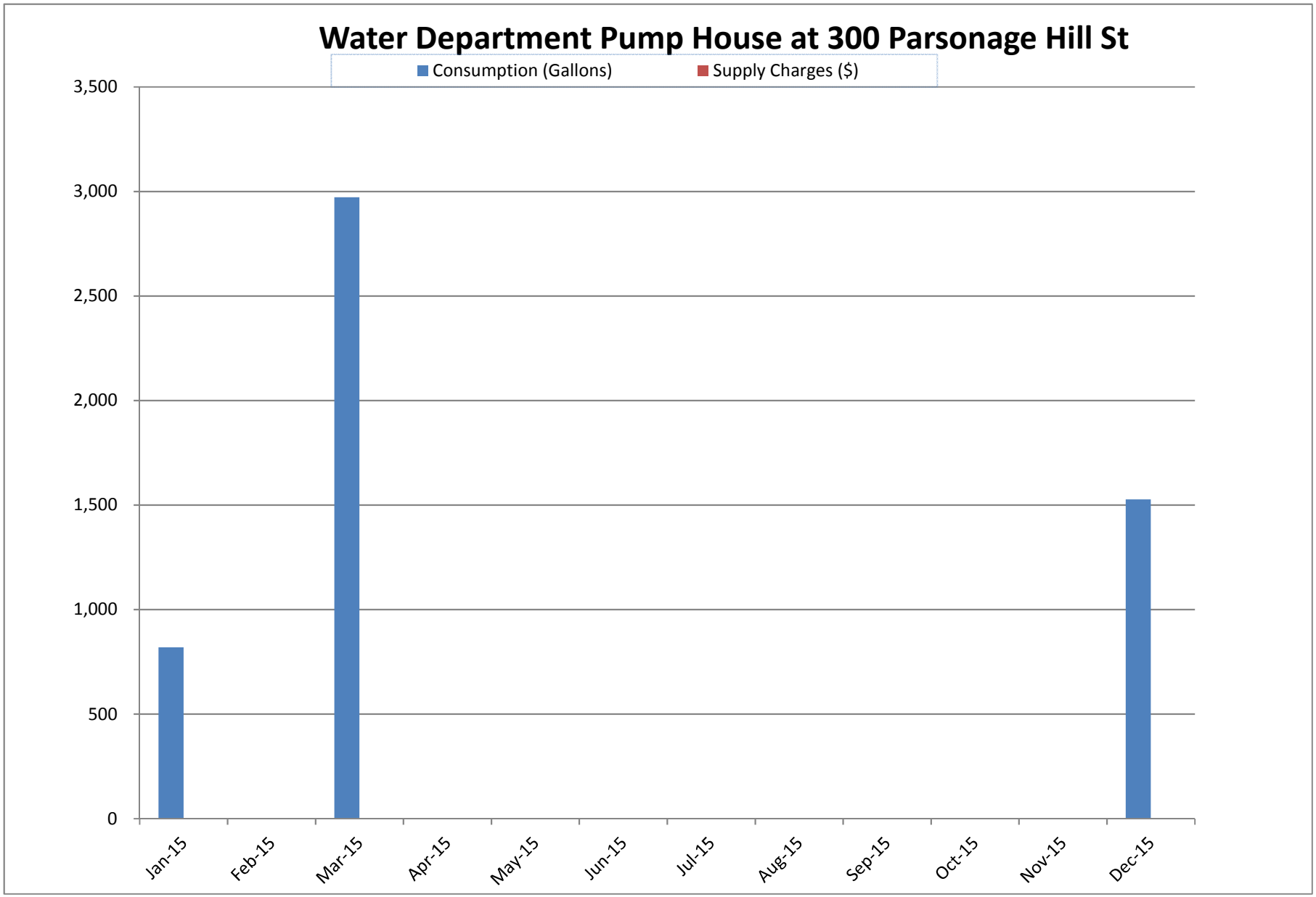

Water Department Pump House at 300 Parsonage Hill St
Consump. (kWh)*
Demand (kW)**
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Consumption (kWh)
1,200
1,000
800
600
400
200
0
Demand (kW)
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Month

East Orange NJBPU LGEA
Water Department Pump House at 300 Parsonage Hill St

Natural Gas Service

Account No.:
Meter No:
Delivery: Finch Fuel Oil
Rate

Month	Consumption (Gallons)	Delivery Charges ($)	Supply Charges ($)	Total Charges ($)	Rate ($/Gallon)
January-15	819.00			1,213.35	1.48
March-15	2,972.00			5,201.59	1.75
December-15	1,527.00			2,292.18	1.50
Total (12 Months)	**5,318**	**$ -**	**$ -**	**$ 8,707.12**	**$ 1.64**

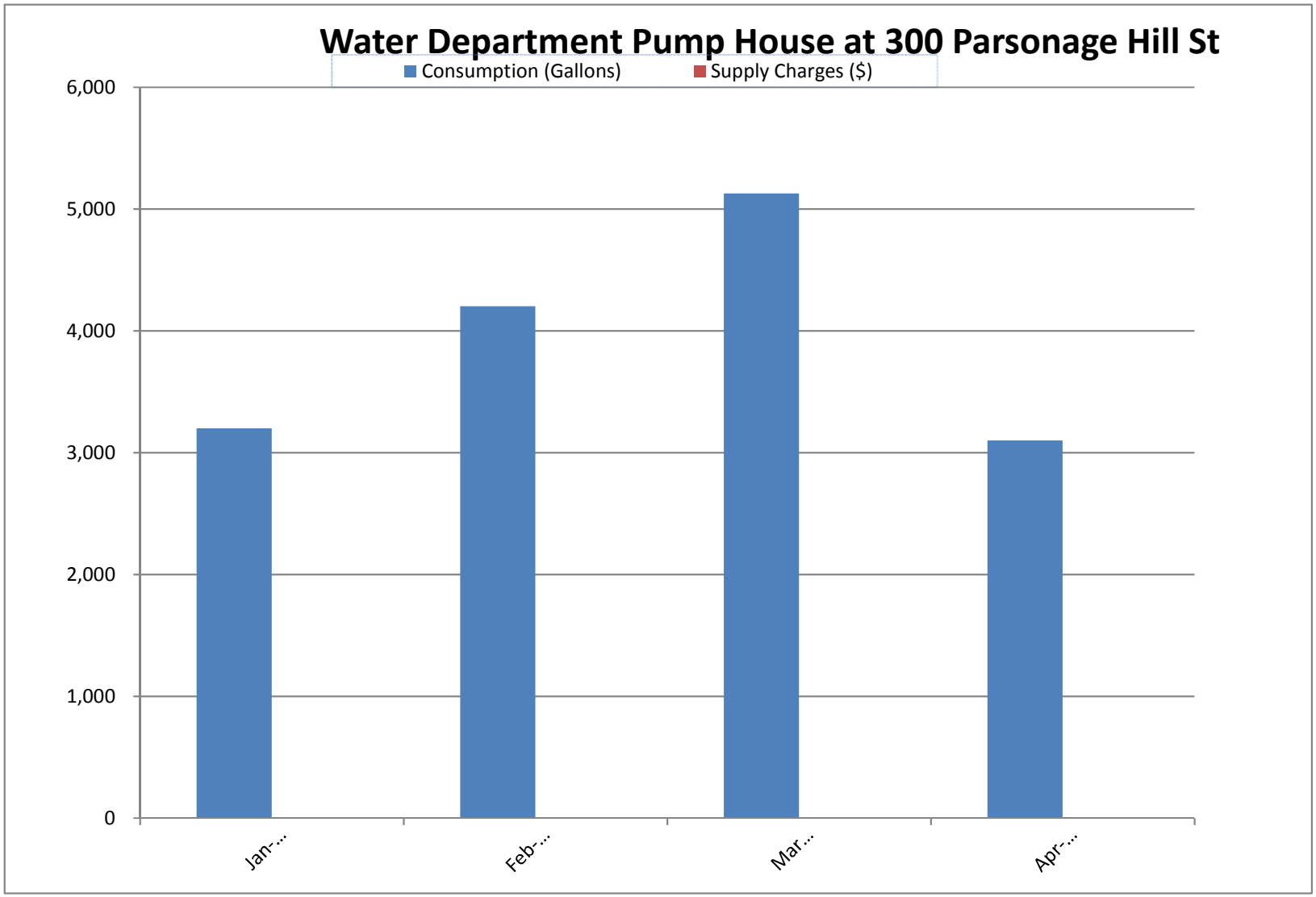

Water Department Pump House at 300 Parsonage Hill St
Consumption (Gallons)
Supply Charges ($)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

East Orange NJBPU LGEA
Water Department Pump House at 300 Parsonage Hill St

Natural Gas Service

Account No.:
Meter No:
Delivery: Finch Fuel Oil
Rate

Month	Consumption (Gallons)	Delivery Charges ($)	Supply Charges ($)	Total Charges ($)	Rate ($/Gallon)
January-15	3,200.00			5,924.50	1.85
February-15	4,201.00			8,298.60	1.98
March-15	5,128.00			8,175.71	1.59
April-15	3,100.00			6,139.55	1.98
Total (12 Months)	**15,629**	**$ -**	**$ -**	**$ 28,538.36**	**$ 1.83**


Water Department Pump House at 300 Parsonage Hill St
Consumption (Gallons)
Supply Charges ($)
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-...
Feb-...
Mar...
Apr-...

PSE&G ELECTRIC SERVICE TERRITORY
Last Updated: 7/21/15

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Abest Power & Gas of NJ, LLC 202 Smith Street Perth Amboy, NJ 08861	(888)987-6937 www.AbestPower.com	**R/C/I** **ACTIVE**
AEP Energy, Inc. f/k/a BlueStar Energy Services 309 Fellowship Road, Fl. 2 Mount Laurel, NJ 08054	(866) 258-3782 www.aepenergy.com	**R/C/I** **ACTIVE**
Agera Energy, LLC 115 route 46, Building F Parsippany, NJ 07054	(844) 692-4372 www.ageraenergy.com	R/C/I
Alpha Gas and Electric, LLC 641 5th Street Lakewood, NJ 08701	(855) 553-6374 www.alphagasandelectric.com	**R/C** **ACTIVE**
Ambit Northeast, LLC d/b/a Ambit Energy 103 Carnegie Center Suite 300 Princeton, NJ 08540	877-282-6284 www.ambitenergy.com	**R/C** **ACTIVE**
American Power & Gas of NJ, LLC - 10000 Lincoln Drive East – Suite 201Marlton, NJ 08053	(800) 205-7491 www.GoAPG.com	**R/C/I**
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	**C/I** **ACTIVE**
Amerigreen Energy, Inc. 333 Sylvan Avenue, Suite 305 Englewood Cliffs, NJ 07632	888-559-4567 www.amerigreen.com	**C/I** **ACTIVE**
AP Gas & Electric, (NJ) LLC 10 North Park Place, Suite 420 Morristown, NJ 07960	(855) 544-4895 www.apgellc.com	**R/C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	(888)850-1872 www.AstralEnergyLLC.com	**R/C/I** **ACTIVE**

Barclays Capital Services, Inc. 70 Hudson Street Jersey City, NJ 07302-4585	(800) 526-7000 www.barclays.com	**C** **ACTIVE**
BBPC, LLC d/b/a Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateasternenergy.com	**C** **ACTIVE**
Berkshire Energy Partners, LLC 9 Berkshire Road Landenberg, PA 19350 Attn: Dana A. LeSage, P.E.	(610) 255-5070 www.berkshireenergypartners.com	**C/I** **ACTIVE**
Blue Pilot Energy, LLC 197 State Rte. 18 South Ste. 3000 East Brunswick, NJ 08816	(800) 451-6356 www.bluepilotenergy.com	**R/C** **ACTIVE**
Brick Standard, LLC 235 Hudson Street Suite 1 Hoboken, NJ 07030	(201)706-8101 www.standardalternative.com	**C/I** **ACTIVE**
CCES LLC dba Clean Currents Energy Services 566 Terhune Street Teaneck, NJ 07666	(877) 933-2453 www.cleancurrents.com	**R/C** **ACTIVE**
Champion Energy Services, LLC 1200 Route 22 Bridgewater, NJ 08807	(888) 653-0093 www.championenergyservices.com	**R/C/I** **ACTIVE**
Choice Energy, LLC 4257 US Highway 9, Suite 6C Freehold, NJ 07728	(888) 565-4490 www.4choiceenergy.com	**R/C** **ACTIVE**
Clearview Electric, Inc. 1744 Lexington Avenue Pennsauken, NJ 08110	(888) CLR-VIEW (800) 746- 4702 www.clearviewenergy.com	**R/C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07446	1-866-587-8674 www.commerceenergy.com	**R/C** **ACTIVE**
Community Energy Inc. 51 Sandbrook Headquarters Road Stockton, NJ 08559	(866)946-3123 www.communityenergyinc.com	**R/C/I** **ACTIVE**

ConEdison Solutions Cherry Tree Corporate Center 535 State Highway Suite 180 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Constellation New Energy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.constellation.com	**R** **ACTIVE**
Constellation Energy Services, Inc. **116 Village Boulevard** **Suite 200** **Princeton, NJ 08540**	1 (800) 536-0151 www.integrysenergy.com	**R/C/I**
Corporate Services Support Corp. **665 Howard Avenue** **Somerset, NJ 08873**	1(800) 761-4000 www.morganstanley.com	**C**
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(800) 325-2000 www.creditsuisse.com	**C** **ACTIVE**
Direct Energy Business, LLC 1 Hess Plaza Woodbridge	(888) 925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Business Marketing, LLC (fka Hess Energy Marketing) 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 925-9115 http://www.business.directenergy.com/small-business	**C/I** **ACTIVE**

Direct Energy Services, LLC **1 Hess Plaza** **Woodbridge, NJ 07095**	1 (866) 348-4193 www.directenergy.com	**C/I** **INACTIVE**
Discount Energy Group, LLC 811 Church Road, Suite 149 Cherry Hill, New Jersey 08002	(800) 282-3331 www.discountenergygroup.com	**R/C** **ACTIVE**
DTE Energy Supply, Inc. One Gateway Center, Suite 2600 Newark, NJ 07102	(877) 332-2450 www.dtesupply.com	**C/I** **ACTIVE**
EDF Energy Services, LLC 1 Meadowlands Plaza Suite 200, Office No. 246 East Rutherford, NJ 07073	1 (877) 432-4530 www.edfenergyservices.com	**C/I**
Energy.me Midwest LLC 90 Washington Blvd Bedminster, NJ 07921	(855) 243-7270 www.energy.me	**R/C/I** **ACTIVE**
Energy Plus Holdings LLC 309 Fellowship Road East Gate Center, Suite 200 Mt. Laurel, NJ 08054	(877) 866-9193 www.energypluscompany.com	**R/C** **ACTIVE**
EnerPenn d/b/a **YEP Energy** 89 Headquarters Plaza North #1463 Morristown, NJ 07960	(855) 363-7736 www.yepenergyNJ.com	**R/C/I** **ACTIVE**
Ethical Electric Benefit Co. d/b/a Ethical Electric/d/b/a Clean Energy Option 100 Overlook Center, 2nd Fl. Princeton, NJ 08540	(888) 444-9452 www.ethicalelectric.com	**R/C** **ACTIVE**
Energy Service Providers, Inc., d/b/a New Jersey Gas & Electric 1 Bridge Plaza fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.njgande.com	**R/C** **ACTIVE**
Everyday Energy, LLC **One International Blvd., Suite 400** **Mahwah, NJ 07495-0400**	844-684-5506 www.energyrewards.comcast.com	**R/I**

FirstEnergy Solutions 150 West State Street Trenton, NJ 08608	(888) 254-63590- www.fes.com	**C/I** **ACTIVE**
First Point Power, LLC 90 Washington Valley Road Bedminister, NJ 07921	(888) 875-1711 www.firstpointpower.com	**R/C/I**
Frontier Utilities Northeast, LLC 199 New Road, Suite 61-187 Linwood, NJ 08221	(877) 437-6930 www.frontierutilities.com	**R/C/I**
Gateway Energy Services Corporation **1 Hess Plaza** **Woodbridge, NJ 07095**	(800) 805-8586 www.gesc.com	**R/C** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08837	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
GDF Suez Retail Energy Solutions LLC d/b/a THINK ENERGY 333 Thornall St. Sixth Floor Edison, NJ 08819	1-866-252-0078 www.mythinkenergy.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Global Energy Marketing LLC 129 Wentz Avenue Springfield, NJ 07081	(800) 542-0778 www.globalp.com	**R/C/I** **ACTIVE**
Greenlight Energy, Inc. **2608 25th Road** **Astoria, NY 11102**	(888) 453-4427 www.greenlightenergy.us	**R**
Green Mountain Energy Company 211 Carnegie Center Drive Princeton, NJ 08540	(866) 767-5818 www.greenmountain.com/commercial-home	**C/I** **ACTIVE**

Harborside Energy LLC 101 Hudson Street Suite 2100 Jersey City, NJ 07302	(877) 940-3835 www.harborsideenergynj.com	**R/C** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	(888) 264-4908 www.hikoenergy.com	**R/C/I** **ACTIVE**
Holcim (US) Inc. 595 Morgan Boulevard Camden, NJ 08104	(800) 831-9507 ext. 4354 www.holcim.us	**I**
Hudson Energy Services, LLC 7 Cedar Street Ramsey, New Jersey 07466	(877) Hudson 9 www.hudsonenergyservices.com	**C** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	(877) 887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Independence Energy Group, LLC 211 Carnegie Center Princeton, NJ 08540	(877) 235-6708 www.chooseindependence.com	**R/C** **ACTIVE**
Inspire Energy Holdings LLC 923 Haddonfield Road 3rd Fl. Building B2 Cherry Hill, NJ 08002	(866) 403-2620 www.inspireenergy.com	**R/C/I**
Integrys Energy Services, Inc. 33 Wood Ave, South, Suite 610 Iselin, NJ 08830	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Jsynergy, LLC 445 Central Ave. Suite 204 Cedarhurst, NY 11516	(516) 331-2020 Jsynergyllc.com	**R/C/I** **ACTIVE**
Kuehne Chemical Company, Inc. 86 North Hackensack Avenue South Kearney, NJ 07032	(973) 589-0700 kuehnechemical@comcast.net	**I**

Liberty Power Delaware, LLC 1973 Highway 34, Suite 211 Wall, NJ 07719	(866) 769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**
Liberty Power Holdings, LLC 1973 Highway 34, Suite 211 Wall, NJ 07719	(866) 769-3799 www.libertypowercorp.com	**R/C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Marathon Power LLC 302 Main Street Paterson, NJ 07505	(888) 779-7255 www.mecny.com	**R/C/I** **ACTIVE**
MP2 Energy NJ, LLC 111 River Street, Suite 1204 Hoboken, NJ 07030	(877) 238-5343 www.mp2energy.com	**R/C/I** **ACTIVE**
Natures Current, LLC 95 Fairmount Avenue Philadelphia, Pennsylvania 19123	(215) 464-6000 www.naturescurrent.com	**R/C/I** **ACTIVE**
MPower Energy NJ LLC One University Plaza, Suite 507 Hackensack, NJ 07601	(877) 286-7693 www.mpowerenergy.com	**R/C/I** **ACTIVE**
NATGASCO, Inc. (Supreme Energy, Inc.) 532 Freeman St. Orange, NJ 07050	(800) 840-4427 www.supremeenergyinc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	(866) 568-0290 www.njgande.com	**R/C/** **ACTIVE**
NextEra Energy Services New Jersey, LLC 651 Jernee Mill Road Sayreville, NJ 08872	(877) 528-2890 Commercial (800) 882-1276 Residential www.nexteraenergyservices.com	**R/C/I** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.noblesolutions.com	**C/I** **ACTIVE**

Nordic Energy Services, LLC 50 Tice Boulevard, Suite 340 Woodcliff Lake, NJ 07677	(877) 808-1027 www.nordiceenergy.us.com	**R/C/I** **ACTIVE**
North American Power and Gas, LLC 222 Ridgedale Avenue Cedar Knolls, NJ 07927	(888) 313-9086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 521-5861 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Park Power, LLC 1200 South Church St. Suite 23 Mount Laurel, NJ 08054	(856) 778-0079 www.parkpower.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	(855) 32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
Power Management Co., LLC b/b/a PMC Lightsavers Limited Liability Company 1600 Moseley Road Victor, NY 14564	(585) 249-1360 www.powermanagementco.com	**C/I** **ACTIVE**
PPL Energy Plus, LLC Shrewsbury Executive Offices 788 Shrewsbury Ave., Suite 2178 Tinton Falls, NJ 07724	(800) 281-2000 www.pplenergyplus.com	**C** **/I** **ACTIVE**
Progressive Energy Consulting, LLC PO Box 4582 Wayne, New Jersey 07474	(917) 837-7400 Progressivenrg@optionline.net	**R/C/I** **ACTIVE**

Prospect Resources, Inc. 208 W. State Street Trenton, NJ 08608-1002	(847) 673-1959 www.prospectresources.com	**C** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Reliant Energy 211 Carnegie Center Princeton, NJ 08540	(877) 297-3795 (877) 297-3780 www.reliant.com	**R/C/I** **ACTIVE**
ResCom Energy LLC 18C Wave Crest Ave. Winfield Park, NJ 07036	(888) 238-4041 http://rescom-energy.com	**R/C/I** **ACTIVE**
Residents Energy, LLC 550 Broad Street Newark, NJ 07102	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(888) 625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**
Save on Energy, LLC 1101 Red Ventures Drive Fort Mill, SC 29707	1 (877)-658-3183 www.saveonenergy.com	**R/C**
SFE Energy One Gateway Center Suite 2600 Newark, NJ 07012	1 (877) 316-6344 www.sfeenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
SmartEnergy Holdings, LLC 100 Overlook Center 2nd Floor Princeton, NJ NJ 08540 United States of America	(800) 443-4440 www.smartenergy.com	**R/C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Spark Energy Gas, LP/ Spark Energy	(713)600-2600	**R/C/I**

2105 City West Blvd. Suite 100 Houston, TX 77042	www.sparkenergy.com	**ACTIVE**
Sperian Energy Corp. 1200 Route 22 East, Suite 2000 Bridgewater, NJ 08807	(888) 682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Starion Energy PA Inc. 101 Warburton Avenue Hawthorne, NJ 07506	(800) 600-3040 www.starionenergy.com	**R/C/I** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Rd., Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Services, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Talen Energy Marketing, LLC **788 Shrewsbury Avenue, Suite 2178 Tinton Falls, NJ 07724**	(888) 289-7693 www.pplenergyplus.com/*	**R/C**
Texas Retail Energy LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 Attn: Chris Hendrix	(866) 532-0761 Texasretailenergy.com	**C/I** **ACTIVE**
TransCanada Power Marketing Ltd. 190 Middlesex Essex Turnpike, Suite 200 Iselin, NJ 08830	(877) MEGAWAT www.transcanada.com/powermarketing	**C/I** **ACTIVE**
TriEagle Energy, LP 90 Washington Valley Rd Bedminster, NJ 07921	(877) 933-2453 www.trieagleenergy.com	**R/C/I** **ACTIVE**

UGI Energy Services, Inc. **dba UGI Energy Link** 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(800) 427-8545 www.ugienergylink.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza Suite 301 Parsippany, NJ 07054	(800) 388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy 2001 Route 46, Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	(888) 997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	(855) 732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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***CUSTOMER CLASS** - **R – RESIDENTIAL C – COMMERCIAL I - INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Agera Energy, LLC **115 route 46, Building F** **Parsippany, NJ 07054**	**(844) 692-4372** **www.ageraenergy.com**	**R/C/I**
Ambit Northeast, LLC d/b/a Ambit Energy 103 Carnegie Center Suite 300 Princeton, NJ 08540	877-282-6284 www.ambitenergy.com	**R/C** **ACTIVE**
American Power & Gas of NJ, LLC 10000 Lincoln Drive East – Suite 201 Marlton, NJ 08053	(800) 2057491 www.GoAPG.com	**R/C/I**
Amerigreen Energy, Inc. 333 Sylvan Avenue Suite 305 Englewood Cliffs, NJ 07632	(888)559-4567 www.amerigreen.com	**C/I** **ACTIVE**
Astral Energy LLC 16 Tyson Place Bergenfield, NJ 07621	888-850-1872 www.AstralEnergyLLC.com	**R/C/I** **ACTIVE**
BBPC, LLC Great Eastern Energy 116 Village Blvd. Suite 200 Princeton, NJ 08540	888-651-4121 www.greateasternenergy.com	**C** **ACTIVE**
Choice Energy, LLC **4257 US Highway 9, Suite 6C** **Freehold, NJ 07728**	(888) 565-4490 www.4choiceenergy.com	**R/C/I**
Clearview Electric Inc. d/b/a Clearview Gas 1744 Lexington Ave. Pennsauken, NJ 08110	800-746-4720 www.clearviewenergy.com	**R/C** **ACTIVE**

Colonial Energy, Inc. 83 Harding Road Wyckoff, NJ 07481	845-429-3229 www.colonialgroupinc.com	**C/I** **ACTIVE**
Commerce Energy, Inc. 7 Cedar Terrace Ramsey, NJ 07746	888 817-8572 www.commerceenergy.com	**R** **ACTIVE**
Compass Energy Services, Inc. 33 Wood Avenue South, 610 Iselin, NJ 08830	866-867-8328 www.compassenergy.net	**C/I** **ACTIVE**
Compass Energy Gas Services, LLC 33 Wood Avenue South Suite 610 Iselin, NJ 08830	866-867-8328 www.compassenergy.net	**C/I** **ACTIVE**
ConocoPhillips Company 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-646-4427 www.conocophillips.com	**C/I** **ACTIVE**
Consolidated Edison Energy, Inc. **d/b/a Con Edison Solutions** 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-686-1383 x2130 www.conedenergy.com	
Consolidated Edison Solutions, Inc. Cherry Tree Corporate Center 535 State Highway 38, Suite 140 Cherry Hill, NJ 08002	888-665-0955 www.conedsolutions.com	**C/I** **ACTIVE**
Constellation NewEnergy-Gas Division, LLC 116 Village Boulevard, Suite 200 Princeton, NJ 08540	800-785-4373 www.constellation.com	**C/I** **ACTIVE**
Constellation Energy Gas Choice, Inc. 116 Village Blvd., Suite 200 Princeton, NJ 08540	800-785-4373 www.constellation.com	**R/C/I** **ACTIVE**
Constellation Energy Services Natural Gas, LLC **116 Village Boulevard**	1 (800) 536-0151	**C/I**

Suite 200 **Princeton, NJ 08540**	www.integrysenergy.com	
Direct Energy Business, LLC 1 Hess Plaza Woodbridge, NJ 07095	888-925-9115 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Business Marketing, LLC (fka Hess Energy Marketing) One Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 http://www.business.directenergy.com/	**C/I** **ACTIVE**
Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC) One Hess Plaza Woodbridge, NJ 07095	(888) 925-9115 http://www.business.directenergy.com/small-business	**C/I** **ACTIVE**
Direct Energy Services, LLC **1 Hess Plaza** **Woodbridge, NJ 07095**	1 (866) 348-4193 www.directenergy.com	**C/I** **INACTIVE**
Dominion Retail, Inc. d/b/a Dominion Energy Solutions **395 Route #70 West, Suite 125 Lakewood, NJ 08701**	(866)237-4765 www.dominionenergy.com	**R/C**
Everyday Energy, LLC **One International Blvd., Suite 400** **Mahwah, NJ 07495-0400**	844-684-5506 www.energyrewards.comcast.com	**R/I**
Frontier Utilities Northeast, LLC 199 New Road, Suite 61-187 Linwood, NJ 08221	(877) 437-6930 www.frontierutilities.com	**R/C/I**
Glacial Energy of New Jersey, Inc. 21 Pine Street, Suite 237 Rockaway, NJ 07866	888-452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Gateway Energy Services Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 805-8586 www.gesc.com	**R/C** **ACTIVE**

Global Energy Marketing, LLC 129 Wentz Avenue Springfield, NJ 07081	800-542-0778 www.globalp.com	**C/I** **ACTIVE**
Great Eastern Energy 116 Village Blvd., Suite 200 Princeton, NJ 08540	888-651-4121 www.greateastern.com	**C/I** **ACTIVE**
Greenlight Energy 2608 25th Road Astoria, NY 11102	(888) 453-4427 www.greenlightenergy.us	**R** **ACTIVE**
Harborside Energy LLC 101 Hudson Street, Suite 2100 Jersey City, NJ 07302	877-940-3835 www.harborsideenergynj.com	**R/C** **ACTIVE**
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
HIKO Energy, LLC 655 Suffern Road Teaneck, NJ 07666	888 264-4908 www.hikoenergy.com	**R/C/I** **ACTIVE**
Hudson Energy Services, LLC 7 Cedar Street Ramsey, NJ 07466	877- Hudson 9 www.hudsonenergyservices.com	**C** **ACTIVE**
IDT Energy, Inc. 550 Broad Street Newark, NJ 07102	877-887-6866 www.idtenergy.com	**R/C** **ACTIVE**
Infinite Energy dba Intelligent Energy 1200 Route 22 East Suite 2000 Bridgewater, NJ 08807-2943	(800) 927-9794 www.InfiniteEnergy.com	**R/C/I** **ACTIVE**
Integrys Energy Services-Natural Gas, LLC 101 Eisenhower Parkway Suite 300 Roseland, NJ 07068	(800) 536-0151 www.integrysenergy.com	**C/I** **ACTIVE**
Jsynergy LLC 445 Cental Ave. Suite 204 Cedarhurst, NY 11516	(516) 331-2020 www.Jsnergyllc.com	**R/C/I** **ACTIVE**
Major Energy Services, LLC 1001 East Lawn Drive Teaneck NJ 07666	888-625-6760 www.majorenergy.com	**R/C/I** **ACTIVE**

Marathon Power LLC 302 Main Street Paterson, NJ 07505	888-779-7255 www.mecny.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	1-877-750-7046 www.metromediaenergy.com	**C/I** **ACTIVE**
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	888-53-Metro www.metroenergy.com	**R/C** **ACTIVE**
MPower Energy NJ LLC One University Plaza, Suite 507 Hackensack, NJ 07601	877-286-7693 www.mpowerenergy.com	**R/C/I** **ACTIVE**
NATGASCO (Supreme Energy, Inc.) 532 Freeman Street Orange, NJ 07050	800-840-4427 www.supremeenergyinc.com	**R/C/I** **ACTIVE**
New Energy Services LLC 101 Neptune Avenue Deal, New Jersey 07723	800-660-3643 www.newenergyservicesllc.com	**R/C/I** **ACTIVE**
New Jersey Gas & Electric 10 North Park Place Suite 420 Morristown, NJ 07960	866-568-0290 www.njgande.com	**R/C** **ACTIVE**
Noble Americas Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095	877-273-6772 www.noblesolutions.com	**C/I** **ACTIVE**
North American Power & Gas, LLC d/b/a North American Power 197 Route 18 South Ste. 300 New Brunswick, NJ 08816	888- 313-8086 www.napower.com	**R/C/I** **ACTIVE**
North Eastern States, Inc. d/b/a Entrust Energy 90 Washington Valley Road Bedminster, NJ 07921	(888) 521-5861 www.entrustenergy.com	**R/C/I** **ACTIVE**
Oasis Power, LLC d/b/a Oasis Energy 11152 Westheimer, Suite 901 Houston, TX 77042	(800)324-3046 www.oasisenergy.com	**R/C** **ACTIVE**

Palmco Energy NJ, LLC One Greentree Centre 10,000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**R/C/I** **ACTIVE**
Plymouth Rock Energy, LLC 338 Maitland Avenue Teaneck, NJ 07666	855-32-POWER (76937) www.plymouthenergy.com	**R/C/I** **ACTIVE**
PPL EnergyPlus, LLC **Shrewsbury Executive Offices** 788 Shrewsbury Avenue Suite 2200 Tinton Falls, NJ 07724	(732) 741-0505 www.pplenergyplus.com	**C/I** **ACTIVE**
Public Power & Utility of New Jersey, LLC One International Blvd, Suite 400 Mahwah, NJ 07495	(888) 354-4415 www.ppandu.com	**R/C/I** **ACTIVE**
Residents Energy, LLC 550 Broad Street Newark, NJ 07102	(888) 828-7374 www.residentsenergy.com	**R/C**
Respond Power LLC 1001 East Lawn Drive Teaneck, NJ 07666	(877) 973-7763 www.respondpower.com	**R/C/I** **ACTIVE**
Save on Energy, LLC 1101 Red Ventures Drive Fort Mill, SC 29707	1 (877) 658-3183 www.saveonenergy.com	**R/C** **ACTIVE**
SFE Energy One Gateway Center Suite 2600 Newark, NJ 07012	1 (877) 316-6344 www.sfeenergy.com	**R/C/I** **ACTIVE**
S.J. Energy Partners, Inc. 208 White Horse Pike, Suite 4 Barrington, NJ 08007	(800) 695-0666 www.sjnaturalgas.com	**C** **ACTIVE**
Star Energy Partners, LLC **CEO Corporate Center** **1812 Front Street** **Scotch Plains, NJ 07076**	(855427-7827 www.starenergypartners.com	**R/C/I**
South Jersey Energy Company 1 South Jersey Plaza, Route 54	800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**

Folsom, NJ 08037		
SouthStar Energy d/b/a New Jersey Energy 1085 Morris Avenue, Suite 155 Union, NJ 07083	(866) 477-8823 www.newjerseyenergy.com	**R/C** **ACTIVE**
Spark Energy Gas, LP/ Spark Energy 2105 City West Blvd. Suite 100 Houston, TX 77042	(713)600-2600 www.sparkenergy.com	**R/C/I** **ACTIVE**
Sperian Energy Corp. Bridgewater Center 1200 Route 22 East Bridgewater, NJ 08807	888-682-8082 www.sperianenergy.com	**R/C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	855-466-2842 www.spragueenergy.com	**C/I** **ACTIVE**
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	800-640-6457 www.stuyfuel.com	**C** **ACTIVE**
Stream Energy New Jersey, LLC 309 Fellowship Road Suite 200 Mt. Laurel, NJ 08054	(877) 369-8150 www.streamenergy.net	**R/C** **ACTIVE**
Summit Energy Services, Inc. 10350 Ormsby Park Place Suite 400 Louisville, KY 40223	1 (800) 90-SUMMIT www.summitenergy.com	**C/I** **ACTIVE**
Systrum Energy 1 Bergen Blvd. Fairview, NJ 07022	877-797-8786 www.systrumenergy.com	**R/C/I** **ACTIVE**
Talen Energy Marketing, LLC **788 Shrewsbury Avenue, Suite 2178** **Tinton Falls, NJ 07724**	(888) 289-7693 www.pplenergyplus.com/*	**R/C**
Tiger Natural Gas, Inc. dba Tiger, Inc. 234 20th Avenue Brick, NJ 008724	888-875-6122 www.tigernaturalgas.com	**R/C/I** **ACTIVE**

UGI Energy Services, Inc. dba UGI Energy Link 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	800-427-8545 www.ugienergylink.com	**C/I** **ACTIVE**
UGI Energy Services, Inc. d/b/a GASMARK 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergylink.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 2001 Route 46 Waterview Plaza, Suite 301 Parsippany, NJ 07054	800-388-3862 www.lowcostpower.com	**R/C** **ACTIVE**
Viridian Energy PA LLC 2001 Route 46, Waterview Plaza Suite 230 Parsippany, NJ 07054	866-663-2508 www.viridian.com	**R/C** **ACTIVE**
Vista Energy Marketing, L.P. 197 State Route 18 South, Suite 3000 South Wing East Brunswick, NJ 08816	888-508-4782 www.vistaenergymarketing.com	**R/C/I** **ACTIVE**
Woodruff Energy 73 Water Street PO Box 777 Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**
Woodruff Energy US LLC 73 Water Street P.O. Box 777 Bridgeton, NJ 08302	800-457-1121 www.woodruffenergy.com	**C/I** **ACTIVE**
XOOM Energy New Jersey, LLC 744 Broad Street. 16th Floor Newark, NJ 07102	888-997-8979 www.xoomenergy.com	**R/C/I** **ACTIVE**
Your Energy Holdings, LLC One International Boulevard Suite 400 Mahwah, NJ 07495-0400	855-732-2493 www.thisisyourenergy.com	**R/C/I** **ACTIVE**

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APPENDIX B

Equipment Inventory

CHA Project # 30993
City of East Orange
Water Department Pump House@Short Hill

Description	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size /Efficiency	Efficiency	Location	Areas/Equipment Served	Date Installed	Remaining Useful Life (years)	Other Info.	Current year	Years Old	ASHRAE life expectancy
Boiler	1	Smith	28A-7	28A-7-115456	HHW Boiler	2,163 MBH energy input and 1,699 MBH energy output	78.5% efficiency	Pump House	Pump house	2005	14		2016	**11**	**25**
HHW Pump	2	Bell & Gossett	1J21	M80121	HHW Pump motors	1/2HP	N/A	Pump House	Pump house	2005	-11		2016	**11**	
DHW Heater	1	Rheem	82SV40-2	RH 0509228761	DHW Heater	4.5kW	100%	Pump House	Pump house	2009	13		2016	7	20
Furnace	1	Lennox	N/A	N/A	Furnace	N/A	N/A	Serving the AHU in the attic for the office area	Conference and Kitchen area	1997	1		2016	18	20
Split AC	1	Trane	TTA090	N083JUKAH	AC for AHU	7.5 ton cooling capacity	N/A	Serving the AHU in the attic for the office area	Conference and Kitchen area	1998	2		2016	18	20
Split AC	1	Trane	TTA060	M002NSJFF	AC for AHU	5 ton cooling capacity	N/A	Serving the AHU in the attic for the office area	Conference and Kitchen area	1997	1		2016	19	20
Low Lift Pump#5	1	Siemens	N/A	7-5114-36505-1-1	Water pump	600HP	N/A	Low Lift Pump House	Water pipes	1999	3		2016	17	20
Low Lift Pump#1	1	GE	5K6337D2	N/A	Water pump	450HP	N/A	Low Lift Pump House	Water pipes	1999	3	Backup for Pump#5	2016	17	20
Low Lift Pump#4	1	Allis-Chalmeers	N/A	1-5157-51936-2-1	Water pump	250HP	N/A	Low Lift Pump House	Water pipes	1999	3		2016	17	20
Low Lift Pump#3	1	Allis-Chalmeers	N/A	1-5157-51936-1-1	Water pump	150HP	N/A	Low Lift Pump House	Water pipes	1999	3	Backup	2016	17	20
Low Lift Pump#2	1				Water pump		N/A	Low Lift Pump House	Water pipes	1999	3	Out of Service	2016	17	20
High Lift Pump#6	1	Siemens		7-5111-36504-2-2	Water pump	300HP	N/A	High Lift Pump House	Water pipes	1999	3		2016	17	20
High Lift Pump#7	1	Siemens		7-5111-36504-2-2	Water pump	100HP	N/A	High Lift Pump House	Water pipes	1999	3	Backup for Pump#6	2016	17	20

Energy Audit of City of East Orange
CHA Project No. 30993
Existing Lighting & Audit Input

Cost of Electricity: **$0.100** **$/kWh**
$8.00 **$/kW**

			EXISTING CONDITIONS									Retrofit Control	
	Area Description	Usage	No. of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh		
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	Describe Usage Type using Operating Hours	No. of fixtures before the retrofit	Lighting Fixture Code	Code from Wattages	Table of Standard Fixture 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)	Retrofit control device	
185LED	Vehicle Storage Building	Storage Areas	12	T 40 R F 4 (ELE)	F44SE	172	2.06	SW	4368	9,016	C-OCC	
41LED	Vehicle Storage Building	Storage Areas	13	1B 40 R F 2 (MAG)	F42SS	94	1.22	SW	4368	5,338	C-OCC	
185LED	Vehicle Storage Building	Storage Areas	10	T 40 R F 4 (ELE)	F44SE	172	1.72	SW	4368	7,513	C-OCC	
41LED	Vehicle Storage Building	Storage Areas	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	4368	821	C-OCC	
247LED	Storage under Conference Room	Storage Areas	8	T 40 R F 3 (MAG)	F43SE	136	1.09	SW	4368	4,752	C-OCC	
185LED	Storage under Conference Room	Storage Areas	9	T 40 R F 4 (ELE)	F44SE	172	1.55	SW	4368	6,762	C-OCC	
185LED	Pump Storage	Storage Areas	12	T 40 R F 4 (ELE)	F44SE	172	2.06	SW	4368	9,016	C-OCC	
5LED	Pump Storage	Storage Areas	13	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.78	SW	4368	3,407	C-OCC	
41LED	Pump Storage	Storage Areas	8	1B 40 R F 2 (MAG)	F42SS	94	0.75	SW	4368	3,285	C-OCC	
41LED	Maintenance Shop	Work shop	6	1B 40 R F 2 (MAG)	F42SS	94	0.56	SW	2000	1,128	C-OCC	
41LED	Maintenance Shop	Work shop	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	2000	376	C-OCC	
71LED	Maintenance Shop	Work shop	1	I 60	I60/1	60	0.06	SW	2000	120	C-OCC	
41LED	Chlorine Room	Pump House	4	1B 40 R F 2 (MAG)	F42SS	94	0.38	SW	8736	3,285	C-OCC	
41LED	Storage	Storage Areas	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	4368	821	C-OCC	
41LED	Hallway	Hallways	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	8736	7,391	C-OCC	
32LED	Diesel Pump	Pump House	46	1T 32 R F 2 (ELE)	F42LL	60	2.76	SW	8736	24,111	C-OCC	
41LED	Loft	Pump House	5	1B 40 R F 2 (MAG)	F42SS	94	0.47	SW	8736	4,106	C-OCC	
41LED	Loft	Pump House	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	8736	821	C-OCC	
5LED	Operation Room	Offices	16	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.96	SW	8736	8,387	C-OCC	
41LED	Operation Room	Offices	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	8736	821	C-OCC	
71LED	Locker room	Restroom	1	I 60	I60/1	60	0.06	SW	4368	262	C-OCC	
41LED	women	Restroom	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	4368	411	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	8736	7,391	C-OCC	
41LED	Conference	Conference	6	1B 40 R F 2 (MAG)	F42SS	94	0.56	SW	4368	2,464	C-OCC	
41LED	Strategy	Offices	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	8736	821	C-OCC	
71LED	Strategy	Offices	2	I 60	I60/1	60	0.12	SW	8736	1,048	C-OCC	
41LED	Café	Cafeteria	4	1B 40 R F 2 (MAG)	F42SS	94	0.38	SW	4732	1,779	C-OCC	
41LED	Locker room	Restroom	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	4368	411	C-OCC	
41LED	Locker room	Restroom	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	4368	821	C-OCC	
71LED	Locker room	Restroom	2	I 60	I60/1	60	0.12	SW	4368	524	C-OCC	
71LED	Locker room	Restroom	2	I 60	I60/1	60	0.12	SW	4368	524	C-OCC	
41LED	Garage Shower	Restroom	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	4368	821	C-OCC	
41LED	Garage Shower	Restroom	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	4368	821	C-OCC	
71LED	Garage Shower	Restroom	2	I 60	I60/1	60	0.12	SW	4368	524	NONE	
41LED	Storage	Storage Areas	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	4368	411	NONE	
64LED	Storage	Storage Areas	1	175 MH	MH175/1	215	0.22	SW	4368	939	NONE	
146LED	Outdoor	Outdoor Lighting	5	High Bay MH 400	MH400/1	458	2.29	SW	4368	10,003	C-OCC	
71LED	Outdoor	Outdoor Lighting	2	I 60	I60/1	60	0.12	SW	4368	524	C-OCC	
64LED	Outdoor	Outdoor Lighting	3	175 MH	MH175/1	215	0.65	SW	4368	2,817	NONE	
64LED	Outdoor	Outdoor Lighting	8	175 MH	MH175/1	215	1.72	SW	4368	7,513	NONE	
71LED	Outdoor	Outdoor Lighting	3	I 60	I60/1	60	0.18	SW	4368	786	NONE	
146LED	Outdoor	Outdoor Lighting	10	High Bay MH 400	MH400/1	458	4.58	SW	4368	20,005	C-OCC	
	Total		**250**				**31.04**			**162,896**		

APPENDIX C

ECM Calculations

Energy Audit of City of East Orange
CHA Project No. 30993
ECM-L3 Lighting Replacements with Occupancy Sensors

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	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 Smart Start 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	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	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
185LED	Vehicle Storage Buildin(	12	T 40 R F 4 (ELE)	F44SE	172	2.1	SW	4368	9,016	12	T 50 R LED	RTLED50	50	0.6	C-OCC	3,058	1,835	7,181	1.5	$ 858.64	$ 2,970.00	$ 320	3.5	3.1
41LED	Vehicle Storage Buildin(	13	1B 40 R F 2 (MAG)	F42SS	94	1.2	SW	4368	5,338	13	STLED4	STLED4	40	0.5	C-OCC	3,058	1,590	3,748	0.7	$ 442.17	$ 4,772.10	$ 20	10.8	10.7
185LED	Vehicle Storage Buildin(	10	T 40 R F 4 (ELE)	F44SE	172	1.7	SW	4368	7,513	10	T 50 R LED	RTLED50	50	0.5	C-OCC	3,058	1,529	5,984	1.2	$ 715.54	$ 2,497.50	$ 270	3.5	3.1
41LED	Vehicle Storage Buildin(	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	4368	821	2	STLED4	STLED4	40	0.1	C-OCC	3,058	245	577	0.1	$ 68.03	$ 848.40	$ 20	12.5	12.2
247LED	Storage under Conference Roon	8	T 40 R F 3 (MAG)	F43SE	136	1.1	SW	4368	4,752	8	T 38 R LED	RTLED38	38	0.3	C-OCC	3,058	930	3,823	0.8	$ 457.55	$ 2,025.00	$ 420	4.4	3.5
185LED	Storage under Conference Roon	9	T 40 R F 4 (ELE)	F44SE	172	1.5	SW	4368	6,762	9	T 50 R LED	RTLED50	50	0.5	C-OCC	3,058	1,376	5,386	1.1	$ 643.98	$ 2,261.25	$ 245	3.5	3.1
185LED	Pump Storage	12	T 40 R F 4 (ELE)	F44SE	172	2.1	SW	4368	9,016	12	T 50 R LED	RTLED50	50	0.6	C-OCC	3,058	1,835	7,181	1.5	$ 858.64	$ 2,970.00	$ 320	3.5	3.1
5LED	Pump Storage	13	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.8	SW	4368	3,407	13	2RTLED	2RTLED	25	0.3	C-OCC	3,058	994	2,413	0.5	$ 285.01	$ 2,767.50	$ 215	9.7	9.0
41LED	Pump Storage	8	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	4368	3,285	8	STLED4	STLED4	40	0.3	C-OCC	3,058	978	2,306	0.4	$ 272.10	$ 2,988.60	$ 20	11.0	10.9
41LED	Maintenance Shop	6	1B 40 R F 2 (MAG)	F42SS	94	0.6	SW	2000	1,128	6	STLED4	STLED4	40	0.2	C-OCC	2,000	480	648	0.3	$ 95.90	$ 2,275.20	$ 20	23.7	23.5
41LED	Maintenance Shop	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	2000	376	2	STLED4	STLED4	40	0.1	C-OCC	2,000	160	216	0.1	$ 31.97	$ 848.40	$ 20	26.5	25.9
71LED	Maintenance Shop	1	I 60	I60/1	60	0.1	SW	2000	120	1	LED15W	LED15W	15	0.0	C-OCC	2,000	30	90	0.0	$ 13.32	$ 141.75	$ 20	10.6	9.1
41LED	Chlorine Room	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	8736	3,285	4	STLED4	STLED4	40	0.2	C-OCC	8,736	1,398	1,887	0.2	$ 209.43	$ 1,561.80	$ 20	7.5	7.4
41LED	Storage	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	4368	821	2	STLED4	STLED4	40	0.1	C-OCC	3,058	245	577	0.1	$ 68.03	$ 848.40	$ 20	12.5	12.2
41LED	Hallway	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	8736	7,391	9	STLED4	STLED4	40	0.4	C-OCC	8,736	3,145	4,246	0.5	$ 471.23	$ 3,345.30	$ 20	7.1	7.1
32LED	Diesel Pump	46	1T 32 R F 2 (ELE)	F42LL	60	2.8	SW	8736	24,111	46	STLED4	STLED4	40	1.8	C-OCC	8,736	16,074	8,037	0.9	$ 892.03	$ 16,543.20	$ 710	18.5	17.7
41LED	Loft	5	1B 40 R F 2 (MAG)	F42SS	94	0.5	SW	8736	4,106	5	STLED4	STLED4	40	0.2	C-OCC	8,736	1,747	2,359	0.3	$ 261.79	$ 1,918.50	$ 20	7.3	7.3
41LED	Loft	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	8736	821	1	STLED4	STLED4	40	0.0	C-OCC	8,736	349	472	0.1	$ 52.36	$ 491.70	$ 20	9.4	9.0
5LED	Operation Room	16	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.0	SW	8736	8,387	16	2RTLED	2T 25 R LED	25	0.4	C-OCC	6,115	2,446	5,940	0.6	$ 647.81	$ 3,375.00	$ 260	5.2	4.8
41LED	Operation Room	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	8736	821	1	STLED4	STLED4	40	0.0	C-OCC	6,115	245	577	0.1	$ 62.84	$ 491.70	$ 20	7.8	7.5
71LED	Locker room	1	I 60	I60/1	60	0.1	SW	4368	262	1	LED15W	LED15W	15	0.0	C-OCC	3,058	46	216	0.0	$ 25.94	$ 141.75	$ 20	5.5	4.7
41LED	women	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	4368	411	1	STLED4	STLED4	40	0.0	C-OCC	3,058	122	288	0.1	$ 34.01	$ 491.70	$ 20	14.5	13.9
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	8736	7,391	9	STLED4	STLED4	40	0.4	C-OCC	6,115	2,201	5,189	0.5	$ 565.57	$ 3,345.30	$ 20	5.9	5.9
41LED	Conference	6	1B 40 R F 2 (MAG)	F42SS	94	0.6	SW	4368	2,464	6	STLED4	STLED4	40	0.2	C-OCC	3,058	734	1,730	0.3	$ 204.08	$ 2,275.20	$ 20	11.1	11.1
41LED	Strategy	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	8736	821	1	STLED4	STLED4	40	0.0	C-OCC	6,115	245	577	0.1	$ 62.84	$ 491.70	$ 20	7.8	7.5
71LED	Strategy	2	I 60	I60/1	60	0.1	SW	8736	1,048	2	LED15W	LED15W	15	0.0	C-OCC	6,115	183	865	0.1	$ 95.13	$ 148.50	$ 20	1.6	1.4
41LED	Café	4	1B 40 R F 2 (MAG)	F42SS	94	0.4	SW	4732	1,779	4	STLED4	STLED4	40	0.2	C-OCC	4,732	757	1,022	0.2	$ 122.95	$ 1,561.80	$ 20	12.7	12.5
41LED	Locker room	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	4368	411	1	STLED4	STLED4	40	0.0	C-OCC	3,058	122	288	0.1	$ 34.01	$ 491.70	$ 20	14.5	13.9
41LED	Locker room	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	4368	821	2	STLED4	STLED4	40	0.1	C-OCC	3,058	245	577	0.1	$ 68.03	$ 848.40	$ 20	12.5	12.2
71LED	Locker room	2	I 60	I60/1	60	0.1	SW	4368	524	2	LED15W	LED15W	15	0.0	C-OCC	3,058	92	432	0.1	$ 51.88	$ 148.50	$ 20	2.9	2.5
71LED	Locker room	2	I 60	I60/1	60	0.1	SW	4368	524	2	LED15W	LED15W	15	0.0	C-OCC	3,058	92	432	0.1	$ 51.88	$ 148.50	$ 20	2.9	2.5
41LED	Garage Shower	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	4368	821	2	STLED4	STLED4	40	0.1	C-OCC	3,058	245	577	0.1	$ 68.03	$ 848.40	$ 20	12.5	12.2
41LED	Garage Shower	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	4368	821	2	STLED4	STLED4	40	0.1	C-OCC	3,058	245	577	0.1	$ 68.03	$ 848.40	$ 20	12.5	12.2
71LED	Garage Shower	2	I 60	I60/1	60	0.1	SW	4368	524	2	LED15W	LED15W	15	0.0	NONE	4,368	131	393	0.1	$ 47.95	$ 13.50	$ -	0.3	0.3
41LED	Storage	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	4368	411	1	STLED4	STLED4	40	0.0	NONE	4,368	175	236	0.1	$ 28.77	$ 356.70	$ -	12.4	12.4
64LED	Storage	1	175 MH	MH175/1	215	0.2	SW	4368	939	1	BAYLED78W	BAYLED78W	93	0.1	NONE	4,368	406	533	0.1	$ 65.00	$ 844.20	$ 100	13.0	11.4
146LED	Outdoor	5	High Bay MH 400	MH400/1	458	2.3	SW	4368	10,003	5	BAYLED78W	BAYLED78W	93	0.5	C-OCC	4,368	2,031	7,972	1.8	$ 972.36	$ 4,355.98	$ 520	4.5	3.9
71LED	Outdoor	2	I 60	I60/1	60	0.1	SW	4368	524	2	LED15W	LED15W	15	0.0	C-OCC	4,368	131	393	0.1	$ 47.95	$ 148.50	$ 20	3.1	2.7
64LED	Outdoor	3	175 MH	MH175/1	215	0.6	SW	4368	2,817	3	BAYLED78W	BAYLED78W	93	0.3	NONE	4,368	1,219	1,599	0.4	$ 195.00	$ 2,532.59	$ 300	13.0	11.4
64LED	Outdoor	8	175 MH	MH175/1	215	1.7	SW	4368	7,513	8	BAYLED78W	BAYLED78W	93	0.7	NONE	4,368	3,250	4,263	1.0	$ 520.01	$ 6,753.56	$ 800	13.0	11.4
71LED	Outdoor	3	I 60	I60/1	60	0.2	SW	4368	786	3	LED15W	LED15W	15	0.0	NONE	4,368	197	590	0.1	$ 71.93	$ 20.25	$ -	0.3	0.3
146LED	Outdoor	10	High Bay MH 400	MH400/1	458	4.6	SW	4368	20,005	10	BAYLED78W	BAYLED78W	93	0.9	C-OCC	4,368	4,062	15,943	3.7	$ 1,944.72	$ 8,576.96	$ 1,020	4.4	3.9
															0	#N/A								#VALUE!
															0	#N/A								#VALUE!
															0	#N/A								#VALUE!
S	Total	250				31.0			162,896	250				11.0			54,559		20.0	12,754	91,333	$6,020		
S																	Demand Savings			20.0	$1,921			
S																	kWh Savings			108,338	$10,834			
S																	Total Savings				$12,754		7.2	6.7

City of East Orange
CHA Project Number: 30993

Rate of Discount (used for NPV) 3.0%

Utility Costs			Yearly Usage	Metric Ton Carbon Dioxide Equivalent	Building Area	Annual Utility Cost		
						Electric	Natural Gas	Fuel Oil
$	0.120	$/kWh blended		0.000420205	20,564	$ 599,651	$ 351	
$	0.100	$/kWh supply	4,886,898	0.000420205				
$	8.00	$/kW	1,047.9	0				
		$/Therm		0.00533471				
water $	5.00	$/kgals		0				
$	2.26	$/Gal	12,000					

Water Department Pump House @ 300 Parsonage Hill

Recommend? Y or N		Item	Savings kW	kWh	therms	No. 2 Oil gal	Water kgal	$	Cost	Simple Payback	Life Expectancy	GHG Reduction (Metric tons)	NJ Smart Start Incentives	Direct Install Eligible (Y/N)	Payback w/ Incentives	Simple Projected Lifetime Savings kW	kWh	therms	kgal/yr	$	ROI	NPV	IRR
Y	ECM-1	Install soft-start on the water supply pump	70.9	0	0	0	0	6,809	$ 94,773	13.9	35	0.0	$ -	N	13.9	2,482.3	0	0	0	$ 238,301	1.5	$38,678	5.9%
Y	ECM-2	Replace heating hot water boiler with high efficiency condensing boiler	0.0	0	0	1,973	0	4,459	$ 87,076	19.5	30	0.0	$ 1,000	N	19.3	0.0	0	0	0	$ -	(1.0)	$1,316	3.1%
Y	ECM-3	Replace the old furnace with high efficiency condensing furnace	0.0	0	0	232	0	525	$ 12,117	23.1	20	0.0	$ 800	N	21.6	0.0	0	0	0	$ -	(1.0)	($3,509)	-0.7%
Y	ECM-4	Replace the old air conditioners	2.4	4,113	0	0	0	645	$ 30,600	47.4	20	1.7	$ 800	N	46.2	48.7	82,255	0	0	$ 14,548	(0.5)	($20,202)	-6.9%
N	ECM-5	Replace old plumbing fixtures with low flow plumbing fixtures	0.0	0	0	18	38	231	$ 30,431	131.8	10	0.0	$ -	N	131.8	0.0	0	0	380	$ 1,898	(0.9)	($28,461)	-31.2%
Y	ECM-L1	Lighting Replacements with Controls (Occupancy Sensors)	20.0	108,338	0	0	0	12,754	91,333	7.2	10	45.5	$ 6,020	N	6.7	200.0	1,083,380	0	0	$ 149,206	0.6	$23,480	8.1%
		Total	**93.4**	**112,451**	**0**	**2,223**	**38**	**$ 25,422**	**$ 346,331**	**13.6**	**20.8**	**47**	**$ 8,620**		**13.3**	**2,731**	**1,165,635**	**-**	**380**	**$ 403,953**	**0.2**	**11,303**	**4.3%**
		Recommended Measures (highlighted green above)	**93.4**	**112,451**	**0**	**2,205**	**0**	**$ 25,191**	**$ 315,900**	**12.5**	**23.0**	**47**	**$ 8,620**	**0**	**12.2**	**2,731**	**1,165,635**	**-**	**-**	**$ 402,055**	**0.3**	**39,763**	**6.1%**
		% of Existing	**9%**	**2%**	**#DIV/0!**	**18%**	**0**																

	City:	Newark, NJ				
	Occupied Hours/Week	168				
		Building Operating Hours	Auditorium Occupied Hours	Gymnasium Occupied Hours	Library Occupied Hours	Classrooms Occupied Hours
Temp	Enthalpy h (Btu/lb) Bin Hours					
102.5						
97.5	35.4 6	6	0	0	0	0
92.5	37.4 31	31	0	0	0	0
87.5	35.0 131	131	0	0	0	0
82.5	33.0 500	500	0	0	0	0
77.5	31.5 620	620	0	0	0	0
72.5	29.9 664	664	0	0	0	0
67.5	27.2 854	854	0	0	0	0
62.5	24.0 927	927	0	0	0	0
57.5	20.3 600	600	0	0	0	0
52.5	18.2 730	730	0	0	0	0
47.5	16.0 491	491	0	0	0	0
42.5	14.5 656	656	0	0	0	0
37.5	12.5 1,023	1,023	0	0	0	0
32.5	10.5 734	734	0	0	0	0
27.5	8.7 334	334	0	0	0	0
22.5	7.0 252	252	0	0	0	0
17.5	5.4 125	125	0	0	0	0
12.5	3.7 47	47	0	0	0	0
7.5	2.1 34	34	0	0	0	0
2.5	1.3 1	1	0	0	0	0
-2.5						
-7.5						

Multipliers	
Material:	1.027
Labor:	1.246
Equipment:	1.124

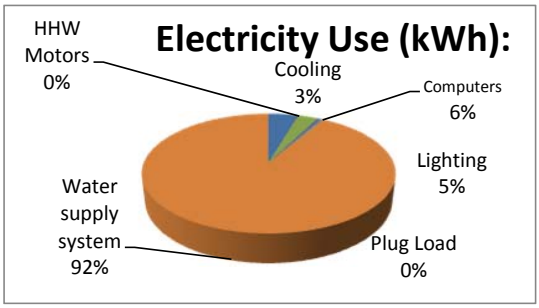
Heating System Efficiency	78%
Cooling Eff (kW/ton)	1.2

Heating		
Hours	13,187	Hrs
Weighted Avg	-1	F
Avg	25	F

Cooling		
Hours	4,333	Hrs
Weighted Avg	68	F
Avg	78	F

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

Utility End Use Analysis			
Electricity Use (kWh):		**Notes/Comments:**	
4,886,898	Total	Based on utility analysis	
220,000	Lighting	From Lighting Calculations	5%
2,000	HHW Motors	Estimated	0%
150,000	Cooling	Calculated from Cooling Capacity	3%
20,000	Plug Load	Estimated	0%
20,000	Computers	Estimated	0%
4,474,898	Water supply system	Remaining	92%
Natural Gas Use (Therms):		**Notes/Comments:**	
-	Total	Based on utility analysis	
0	Boilers		
0	DHW	Based on utility analysis	



City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-1 Install soft-start on the water supply pump

Description: This ECM evaluates the demand reduction of installing soft starts on the water pumps that were stop/start a few times a years due to the power outage or other reasons

Variable Inputs

Electric Rate	$0.10	**$/kWh**
Demand Rate	$8.00	**$/kW**

MOTOR SCHEDULE										Savings Factor		ting Motor Er	Proposed Motor Energy		Energy Savings	
Motor ID	Motor Type	Qty of Savings	HP	Total HP	VFD	Upgrade Motor	Existing Motor Eff.	Demand Reduction %	Annual Hours	Coincidence Factor	Load Factor	Demand Savings (kW)	Demand Savings (kW)	Energy Savings (kWh)	Peak Demand Savings (kW)	Annual Energy Savings (kWh)
Lower Lift Pump#5	Water Pump	1	600.0	600.0	No	N	89.5%	10.0%	8,760	0.740	0.75	37.0	-	-	37.00	-
Low Lift Pump#4	Water Pump	1	250.0	250.0	No	N	89.5%	10.0%	8,760	0.740	0.75	15.4	-	-	15.42	-
High Lift Pump#6	Water Pump	1	300.0	300.0	No	N	89.5%	10.0%	8,760	0.740	0.75	18.5	-	-	18.50	-
														Total:	70.9	-
															$ 6,809	$ -
																$ 6,809

Savings calculation formulas are taken from NJ Protocols document for VFDs

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-1 Install soft-start on the water supply pump - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Soft Start 600HP	1		$ 10,000	$ 10,000		$ 10,270	$ 12,460	$ -	$ 22,730	Estimated from internet price
Soft Start 250HP	1		$ 6,000	$ 10,000		$ 6,162	$ 12,460	$ -	$ 18,622	Estimated from internet price
Soft Start 300HP	1		$ 7,500	$ 10,000		$ 7,703	$ 12,460	$ -	$ 20,163	Estimated from internet price
Wiring	3		$ 1,000	$ 1,500		$ 3,081	$ 5,607	$ -	$ 8,688	Estimated
						$ -	$ -	$ -		
						$ -	$ -	$ -		
						$ -	$ -	$ -		
						$ -	$ -	$ -		

* the contractor quote is a sum cost of replacing the boiler , separating the DHW system and replacing the motors (taking out VFD cost).
**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 70,203	Subtotal
$ 24,571	35% Contingency
$ 94,773	**Total**

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-2 Replace heating hot water boiler with high efficiency condensing boiler

Description: This ECM evaluates adding a high efficiency condensing gas boiler to each boiler plant (two boiler plant). The existing boiler efficiency is about 82% and the proposed boiler efficiency is above 90%. Electrical power consumption due to pumps is considered to be the same for both the proposed system and the baseline system.

Boiler Plant 1

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ -	/ Therm	Natural Gas
Baseline Fuel Cost	$ 2.26	/ Gal	No. 2 Oil
FORMULA CONSTANTS			
Oversize Factor	0.8		
Hours per Day	24		
Infrared Conversion Factor	1.0		1.0 if Boiler, 0.8 if Infrared Heater
EXISTING			
Capacity	1,699,000	btu/hr	Estimated Boiler Load % and Capacity
Heating Combustion Efficiency	78%		Estimated averaged Efficiency
Heating Degree-Day	2,783	Degree-day	
Design Temperature Difference	57	F	
Fuel Conversion	100,000	btu/therm	
PROPOSED			
Capacity	1,699,000	btu/hr	
Efficiency	90%		
SAVINGS			
Fuel Savings	2,723	therms	NJ Protocols Calculation
Fuel Savings	1,972.87	Gallon	
Fuel Cost Savings	$ 4,459		

Savings calculation formulas are taken from NJ Protocols document for Occupancy Controlled Thermostats

Algorithms

$$Gas\ Savings\ (Therms) = \frac{OF \times ((CAPY_{Bi} \times EFF_Q) - (CAPY_{Qi} \times EFF_B \times ICF)) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_B \times ICF \times EFF_Q}$$

Definition of Variables

OF = Oversize factor of standard boiler or furnace (OF=0.8)

$CAPY_{Bi}$ = Total input capacity of the baseline furnace, boiler or heater in Btu/hour

$CAPY_{Qi}$ = Total input capacity of the qualifying furnace, boiler or heater in Btu/hour

HDD_{mod} = HDD by zone and building type

24 = Hours/Day

ΔT = design temperature difference

HC_{fuel} = Conversion from Btu to therms of gas or gallons of oil or propane (100,000 btu/therm; 138,700 btu/gal of #2 oil; 92,000 btu/gal of propane)

EFF_Q = Efficiency of qualifying heater(s) (AFUE %)

EFF_B = Efficiency of baseline heaters (AFUE %)

ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for furnaces/boilers)[2]

Furnaces and Boilers

Component	Type	Value	Source
$AFUE_q$	Variable		Application
$AFUE_b$	Fixed	Furnaces: 78% Boilers: 80% Infrared: 78%	EPACT Standard for furnaces and boilers
$CAPY_{in}$	Variable		Application
ΔT	Variable	See Table Below	1
HDD_{mod}	Fixed	See Table Below	1

Sources:

1. KEMA, *Smartstart Program Protocol Review*. 2009.
2. http://www.spaceray.com/1_space-ray_faqs.php

Adjusted Heating Degree Days by Building Type

Building Type	Heating Energy Density (kBtu/sf)	Degree Day Adjustment Factor	Atlantic City (HDD)	Newark (HDD)	Philadelphia (HDD)	Monticello (HDD)
Education	29.5	0.55	2792	2783	2655	3886
Food Sales	35.6	0.66	3369	3359	3204	4689
Food Service	39.0	0.73	3691	3680	3510	5137
Health Care	53.6	1.00	5073	5057	4824	7060
Lodging	15.0	0.28	1420	1415	1350	1976
Retail	29.3	0.55	2773	2764	2637	3859
Office	28.1	0.52	2660	2651	2529	3701
Public Assembly	33.8	0.63	3199	3189	3042	4452
Public Order/Safety	24.1	0.45	2281	2274	2169	3174
Religious Worship	29.1	0.54	2754	2745	2619	3833
Service	47.8	0.89	4524	4510	4302	6296
Warehouse/Storage	20.2	0.38	1912	1906	1818	2661

Heating Degree Days and Outdoor Design Temperature by Zone

Weather Station	HDD	Outdoor Design Temperature (F)
Atlantic City	5073	13
Newark	5057	14
Philadelphia, PA	4824	15
Monticello, NY	7060	8

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-2 Replace heating hot water boiler with high efficiency condensing boiler - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
2,000 MBH NG Condensing Boiler	1	EA	$ 32,000	$ 6,000		$ 32,864	$ 7,476	$ -	$ 40,340	Vendor Estimate
Flue Installation	1	LS	$2,500.0	$ 2,500.00		$ 2,568	$ 3,115	$ -	$ 5,683	Estimated
controls	1	EA	$2,000.0	$ 2,000.00		$ 2,054	$ 2,492	$ -	$ 4,546	Estimated
Miscellaneous Electrical	1	LS	$ 2,000	$ 2,500		$ 2,054	$ 3,115	$ -	$ 5,169	Estimated
Miscellaneous HW Piping	1	LS	$ 2,000	$ 1,000		$ 2,054	$ 1,246	$ -	$ 3,300	Estimated
Pumps	1	EA	$ 3,500	$ 1,500		$ 3,595	$ 1,869	$ -	$ 5,464	Estimated
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 64,501	Subtotal
$ 22,575	35% Contingency
$ 87,076	**Total**

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-3 Replace the old furnace with high efficiency condensing furnace

Description: This ECM evaluates replacing the old furnace with a high effiency condensing furnace.

Boiler Plant 1

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ -	/ Therm	Natural Gas
Baseline Fuel Cost	$ 2.26	/ Gal	No. 2 Oil
FORMULA CONSTANTS			
Oversize Factor	0.8		
Hours per Day	24		
Infrared Conversion Factor	1.0		1.0 if Boiler, 0.8 if Infrared Heater
EXISTING			
Capacity	200,000	btu/hr	Estimated Boiler Load % and Capacity
Heating Combustion Efficiency	78%		Estimated averaged Efficiency
Heating Degree-Day	2,783	Degree-day	
Design Temperature Difference	57	F	
Fuel Conversion	100,000	btu/therm	
PROPOSED			
Capacity	200,000	btu/hr	
Efficiency	90%		
SAVINGS			
Fuel Savings	320	therms	NJ Protocols Calculation
Fuel Savings	232.24	Gallon	
Fuel Cost Savings	$ 525		

Savings calculation formulas are taken from NJ Protocols document for Occupancy Controlled Thermostats

Algorithms

$$Gas\ Savings\ (Therms) = \frac{OF \times ((CAPY_{Bi} \times EFF_Q) - (CAPY_{Qi} \times EFF_B \times ICF)) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_B \times ICF \times EFF_Q}$$

Definition of Variables

OF = Oversize factor of standard boiler or furnace (OF=0.8)

$CAPY_{Bi}$ = Total input capacity of the baseline furnace, boiler or heater in Btu/hour

$CAPY_{Qi}$ = Total input capacity of the qualifying furnace, boiler or heater in Btu/hour

HDD_{mod} = HDD by zone and building type

24 = Hours/Day

ΔT = design temperature difference

HC_{fuel} = Conversion from Btu to therms of gas or gallons of oil or propane (100,000 btu/therm; 138,700 btu/gal of #2 oil; 92,000 btu/gal of propane)

EFF_Q = Efficiency of qualifying heater(s) (AFUE %)

EFF_B = Efficiency of baseline heaters (AFUE %)

ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for furnaces/boilers)[2]

Furnaces and Boilers

Component	Type	Value	Source
$AFUE_q$	Variable		Application
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$CAPY_{in}$	Variable		Application
ΔT	Variable	See Table Below	1
HDD_{mod}	Fixed	See Table Below	1

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Weather Station	HDD	Outdoor Design Temperature (F)
Atlantic City	5073	13
Newark	5057	14
Philadelphia, PA	4824	15
Monticello, NY	7060	8

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-3 Replace the old furnace with high efficiency condensing furnace - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Furnace	1	EA	$ 3,100	$ 1,000		$ 3,184	$ 1,246	$ -	$ 4,430	RS Means
Flue Installation	1	LS	$1,000.0	$ 1,000.0		$ 1,027	$ 1,246	$ -	$ 2,273	Estimated
Miscellaneous Electrical	1	LS	$1,000.0	$ 1,000.0		$ 1,027	$ 1,246	$ -	$ 2,273	Estimated
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 8,976	Subtotal
$ 3,141	35% Contingency
$ 12,117	**Total**

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-3 Replace the old furnace with high efficiency condensing furnace

Description: This ECM evaluates the energy savings associated with replacing the old non-functional RTUs with new RTUs

Equipment Tag	Equipment Description	General Type	Cooling Capacity (Btu/h)	Heating Capacity from HHW Boiler (Btu/h)
AC-1	Split AC	HVAC	60,000	
AC-2	Split AC	HVAC	90,000	

Item	Value	Units	Formula/Comments	
Demand Rate	$ 8.00	/ kW		
Electricity Rate	$ 0.10	/kWh		
FORMULA CONSTANTS				
Coincidence Factor	0.67		NJ Protocols	
Conversion	3.412	btu/kW		
COOLING - HVAC				
Cooling Capacity	150,000	btu/hr		btuh
Baseline EER	11.0		See Table Below	EERb
Proposed EER	15.0		Equipment	EERq
Equivalent Full Load Hours	1,131	hrs	NJ Protocols	
Demand Savings	2.44	kW		
Energy Savings	4,113	kWh		
SAVINGS				
Demand Savings	2.44	kW		
Energy Savings	4,113	kWh		
Cost Savings	$ 431			

Savings calculation formulas are taken from NJ Protocols document for Electric HVAC Equipment

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM-3 Replace the old furnace with high efficiency condensing furnace - Cost

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
AC-1	1	EA	$ 2,550	$ 1,350	$ -	$ 2,619	$ 1,682	$ -	$ 4,301	RS Means 2012
AC-2	1	EA	$ 4,800	$ 1,500		$ 4,930	$ 1,869	$ -	$ 6,799	RS Means 2012
Electrical - misc.	2	LS	$ 2,000	$ 3,000	$ -	$ 4,108	$ 7,476	$ -	$ 11,584	RS Means 2012

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 22,684	Subtotal
$ 7,939	35% Contingency
$ 30,600	**Total**

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM: Replace urinals and flush valves with low flow

Description: This ECM evaluates the water savings associated with replacing/ upgrading urinals with 0.125 GPF urinals and or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$5.00	$ / kGal
Urinals in Building to be replaced	3	
Average Flushes / Urinal (per Day)	5	
Average Gallons / Flush	1.5	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	3	
Proposed Gallons / Flush	0.125	Gal
Proposed Material Cost of new urinal & valve	$1,200	RS Means 2012
Proposed Installation Cost of new urinal & valve	$1,000	RS Means 2012
Total cost of new urinals & valves		

SAVINGS		
Current Urinal Water Use	8.21	kGal / year
Proposed Urinal Water Use	0.68	kGal / year
Water Savings	7.53	kGal / year
Cost Savings	$38	/ year

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM: Replace toilets and flush valves with low flow

Description: This ECM evaluates the water savings associated with repalcing/ upgrading toilets to 1.28 GPF fixtures and/or flush valves.

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$5.00	$ / kGal
Toilets in Building	4	
Average Flushes / Toilet (per Day)	3	
Average Gallons / Flush	3.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	4	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	15.33	kGal / year
Proposed Toilet Water Use	5.61	kGal / year
Water Savings	9.72	kGal / year
Cost Savings	$49	/ year

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

ECM: Replace faucets with low flow

Description; This ECM evaluates the water savings resulting from replacing/ upgrading faucets to 0.5 gallon per minute flow

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$5.00	$ / kGal
Faucets in Building	4	
Average Uses / Faucet (per day)	3	# Uses
Average Time of Use	300.0	seconds
Average Flowrate	2.0	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	4	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	$ -	/kWh
Number of Faucets	4	
Hours per Day of Usage	0.1	hrs
Days per Year of Facility Usage	230	days
Average Flowrate	2.0	gpm
Proposed Flowrate	0.5	gpm
Heat Content of Water	8.33	Btu/gal/F
Temperature Difference (Intake and Output)	35	F
Water Heating Equipment Efficiency	80%	
Conversion Factor	100,000	Btu/Therm
SAVINGS		
Current Faucet Water Use	27.60	kGal / year
Proposed Faucet Water Use	6.90	kGal / year
Water Savings	20.70	kGal / year
Heating Savings	18	Gallon
Cost Savings	$104	/ year

Savings calculation formulas are taken from NJ Protocols document for Faucet

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

#REF!

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Low-Flow Urinal	3	EA	$ 1,200	$ 1,000	$ -	$ 3,697	$ 3,738	$ -	$ 7,435	Vendor Estimate
Low-Flow Toilet	4	EA	$ 1,400	$ 1,000	$ -	$ 5,751	$ 4,984	$ -	$ 10,735	Vendor Estimate
Low-Flow Faucet	4	EA	$ 700	$ 300	$ -	$ 2,876	$ 1,495	$ -	$ 4,371	Vendor Estimate
						$ -	$ -	$ -	$ -	

**Cost Estimates are for Energy Savings calculations only, do not use for procurement

$ 22,541	Subtotal
$ 7,889	35% Contingency
$ 30,431	**Total**

City of East Orange
CHA Project Number: 30993
Water Department Pump House @ 300 Parsonage Hill

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2012.
Building must have a minimum average electric demand of 200 kW and minimum area of building is 50,000 ft to be most cost-effective for commercial and industrial buildings. However, multifamily buildings with peak demand over 100kW are still eligible. Market manager has the discretion to approve applications that fall below 200kW minimum.

At a minimum, all recommended measures were used for this calculation. To qualify for P4P incentives, the following P4P requirements must be met:

- At least 15% source energy savings
- No more than 50% savings from lighting measures
- up to 70% of lighting savings may be considered but performance target will increase by 1% for each percent over 50%
- Scope should includes two or more unique measures
- Project has at least a 10% internal rate of return
- At least 50% of the source energy savings must come from investor-owned electricity and/or natural gas (note: exemption for fuel conversions)

Total Building Area (Square Feet)	20,564
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilites (BPU)

Incentive #1		
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$599,651	$351
Existing Usage (from utility)	4,886,898	0
Proposed Savings	112,451	0
Existing Total MMBtus	16,664	
Proposed Savings MMBtus	383	
% Energy Reduction	**2.3%**	
Proposed Annual Savings	$25,191	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.00	$0.00
Incentive #3	$0.09	$0.90	$0.005	$0.05	$0.11	$1.25	$0.00	$0.00

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$0
Incentive #2	$0	$0	$0
Incentive #3	$0	$0	$0
Total All Incentives	**$0**	**$0**	**$0**

Total Project Cost	$315,900

		Allowable Incentive
% Incentives #1 of Utility Cost*	0.0%	$0
% Incentives #2 of Project Cost**	0.0%	$0
% Incentives #3 of Project Cost**	0.0%	$0
Total Eligible Incentives***	**$0**	
Project Cost w/ Incentives	$315,900	

Project Payback (years)	
w/o Incentives	w/ Incentives
12.5	12.5

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

** Maximum allowable amount of Incentive #2 is 50% of total project cost.

**Maximum allowable amount of Incentive #3 is 50% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.

Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account; maximum 2 million per project

APPENDIX D

Photovoltaic Analysis

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at http://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

102,744 kWh per Year *

System output may range from 98,829 to 107,624kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.39	5,435	707
February	3.16	6,444	838
March	4.06	8,991	1,169
April	4.83	10,008	1,301
May	5.69	11,837	1,539
June	5.93	11,626	1,511
July	5.77	11,551	1,502
August	5.37	10,689	1,390
September	4.65	9,181	1,194
October	3.61	7,576	985
November	2.34	4,936	642
December	2.01	4,470	581
Annual	**4.15**	**102,744**	**$ 13,359**

Location and Station Identification

Requested Location	300 Parsonage Hill Road Short Hills, NJ 07078
Weather Data Source	(TMY2) NEWARK, NJ 8.3 mi
Latitude	40.7° N
Longitude	74.17° W

PV System Specifications *(Commercial)*

DC System Size	84.9 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	10°
Array Azimuth	190°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.13 $/kWh
Initial Cost	2.60 $/Wdc
Cost of Electricity Generated by System	0.14 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

City of East Orange
Fire Station - Water Department

Cost of Electricity	$0.131	/kWh
Electricity Usage	339,360	kWh/yr
System Unit Cost	$4,000	/kW

Photovoltaic (PV) Solar Power Generation - Screening Assessment

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	Federal Tax Credit	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$339,623	**84.9**	**102,744**	**0**	**$13,459**	**0**	**$13,459**	**$0**	**$25,686**	**25.2**	**8.7**

** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $250 /1000kwh

Area Output*
986 m2
10,613 ft2

Perimeter Output*
182 m
597 ft

Available Roof Space for PV:
(Area Output - 10 ft x Perimeter) x 85%
3,946 ft2

Approximate System Size: Is the roof flat? (Yes/No) Yes

8 watt/ft2
84,906 DC watts
85 kW From PV Watts

PV Watts Inputs***

Array Tilt Angle	10	Enter into PV Watts (always 20 if flat, if pitched - enter estimated roof angle)
Array Azimuth	190	Enter into PV Watts (default)
Zip Code	07019	Enter into PV Watts
DC/AC Derate Factor	0.83	Enter info PV Watts

PV Watts Output
102,744 annual kWh calculated in PV Watts program

% Offset Calc

Usage	339,360	(from utilities)
PV Generation	102,744	(generated using PV Watts)
% offset	30%	

* http://www.freemaptools.com/area-calculator.htm
** http://www.flettexchange.com
*** http://gisatnrel.nrel.gov/PVWatts_Viewer/index.html

APPENDIX E

Photos

Existing water pumps

Existing Furnace

Existing Boiler

Existing AC Units

APPENDIX F

EPA Benchmarking Report

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Water Department Pump House

Primary Property Type: Drinking Water Treatment & Distribution
Gross Floor Area (ft²): 20,564
Built: 1910

For Year Ending: September 30, 2014
Date Generated: April 25, 2016

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Water Department Pump House 300 Parsonage Hill road East Orange, New Jersey 07078	_____ , (____)____-_____	____ _____ , (____)____-_____ _____

Property ID: 4940378

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
951.4 kBtu/ft²

Source EUI
2,688 kBtu/ft²

Annual Energy by Fuel	
Fuel Oil (No. 2) (kBtu)	733,884 (4%)
Electric - Grid (kBtu)	16,674,096 (85%)
Diesel (kBtu)	2,156,802 (11%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	910.4
National Median Source EUI (kBtu/ft²)	2,572.2
% Diff from National Median Source EUI	4%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	2,447

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

____ _____
,
(____)____-_____
_____

Professional Engineer Stamp (if applicable)