

CITY OF EAST ORANGE

EAST ORANGE PUBLIC WORKS

333 Glenwood Ave, East Orange NJ 07017

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

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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 $\pm 20\%$, 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
Public Works	333 Glenwood Ave, East Orange NJ 07017	71,874	1960

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)	NG Savings (therms)	Total Savings (\$)	Payback (years)
Public Works	67,301	5,422	\$24,599	9.1

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 chooses 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

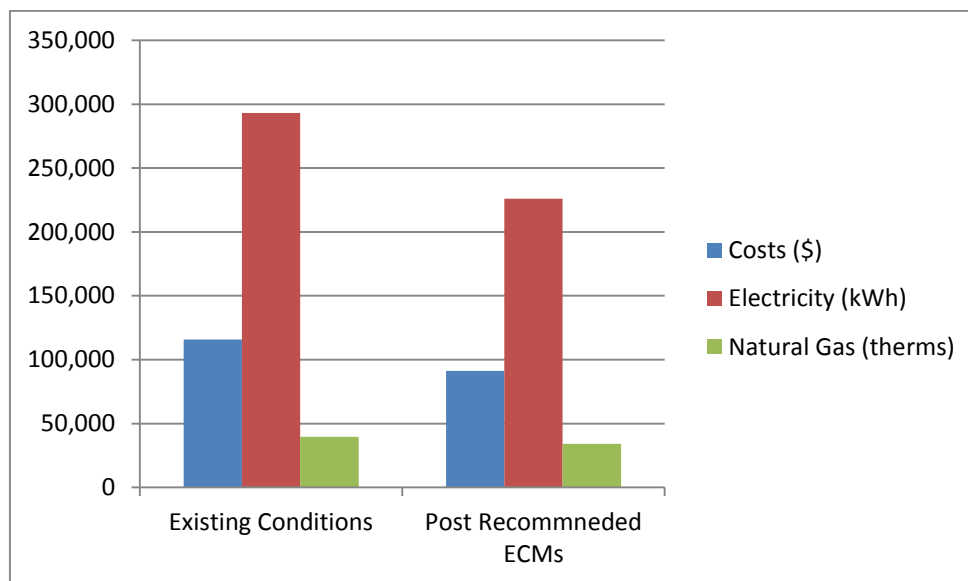
ECM #	Energy Conservation Measure	Est. Costs (\$)	Est. Savings (\$/year)	Payback w/o Incentive	Potential Incentive (\$)*	Payback w/ Incentive	Recommended
ECM-1	Window Replacement	47,600	1,119	42.5	0	42.5	N
ECM-2	Replace the Old Boiler with a Condensing Boiler	68,038	5,313	12.8	1,320	12.6	Y
ECM-3	Install Thermostats on the HHW System	39,096	3,237	12.1	0	12.1	Y
ECM-4	Install Window AC Controller	1,500	156	9.6	0	9.6	Y
ECM-5	Replace the DHW Heaters with Condensing Heaters	5,657	179	31.6	150	30.8	Y
ECM-6	Replace Old Plumbing Fixtures with Low Flow Plumbing Fixtures	37,004	396	93.5	0	93.5	N
ECM-L1	Lighting Replacements with Controls (Occupancy Sensors)	109,996	15,714	7.0	1,640	6.9	Y
Total**		308,891	26,114	11.8	3,110	11.7	
Total(Recommended)		224,287	24,599	9.1	3,110	9.0	

* Incentive shown is per the New Jersey SmartStart Program.

By implementing the recommended ECMs, the building could result in a total of 57.2 metric tons of LIFETIME greenhouse gas (GHG) reduction.

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

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs (\$)	115,767	91,168	21%
Electricity (kWh)	293,280	225,979	23%
Natural Gas (therms)	39,611	34,189	14%
Site EUI (kbtu/SF/Yr)	69.0	58.3	



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: Public Works and Central City Garage

Address: 333 Glenwood Ave, East Orange NJ 07017

Gross Floor Area: 71,874

Number of Floors: Three floors

Year Built: 1960



General

Description of Spaces: The building houses the public works offices and vehicle maintenance garage. It includes public works office, city council offices, meeting rooms, police car garage, car garage, restrooms and mechanical room.

Description of Occupancy: The facility has approximately 43 permanent employees working during the office hours.

Number of Computers: The building has approximately 20 computers.

Building Usage: The regular hours are typically 40 hours per week except holidays.

Construction Materials: Stone, concrete block, and structure steel with brick facade.

Roof: The building has a flat roof which is covered with grey rubber membranes. The roof is believed to be well insulated. The roof is in good condition and therefore no ECMs associated with roof improvements are evaluated.

Windows: The windows are single pane windows which appear to be in poor condition. Therefore, an ECM associated with window replacement was evaluated.

Exterior Doors: Exterior doors are glass doors and in good condition except that the door seals have worn out. Door seals are recommended to be replaced as part of the operations and maintenance (O&M) work.

Heating Ventilation & Air Conditioning (HVAC) Systems

Heating: This building has two heating systems: the office section is heated by a central heating hot water system and the garage is majorly heated by infrared heaters with a few unit heaters. The heating hot water is provided by ten old Hydro-therm boilers which are original to the building. Each of the boiler has a rated 240MBH energy input and about 80% efficiency based on the discussions with facility staff. These boilers are in poor condition and at the end of their useful life span. The heating hot water is circulated by five Bell & Gossett circulation pumps. These five pumps are driven by one 3HP motor, two 1/2HP motor, one 1/4HP motor and one 1/6 HP motor. The hot water is circulated by these pumps to the baseboard heaters and unit heaters throughout the building. The garage area is heated by nine Omega II gas fired infrared heaters. Each heater has about 120MBH heating capacity. Besides the hot water boilers and the infrared heaters, the corridor areas have some small capacity electric unit heaters and the garage has some gas fired and hot water unit heaters.

An ECM related to the boiler replacement was evaluated.

Cooling: The building does not have a central cooling system. The office area is cooled by 5 window AC units. Each of the window AC units has a rated cooling capacity of 1.5 ton. The rest of the building is not cooled.

An ECM related to installing window AC control was evaluated.

Ventilation: The building does not have mechanical ventilation system. The building is ventilated by natural convection from staff opening windows. Therefore, there is no ECMs are associated with ventilation system.

Exhaust: This building has a fractional HP exhaust fan on the roof serving restrooms. The exhaust fans appear to be in good condition and therefore no ECMs associated with exhaust system were evaluated.

Controls Systems

The boilers have an old Honeywell control which was not functioning properly any more. In discussions with the facility staff, it was noted that the majority of the heating control are outdated. The building has 5 heating zones, therefore an ECM related to installing thermostats on each zone to turn off the pump to reduce energy usage is included.

Domestic Hot Water Systems

A gas fired DHW heater located in the boiler room are used to provide DHW for the whole building. The heater has a rated 199.9 MBH heating input and an efficiency of 80%. The heater has a rated storage capacity of 80 gallon. We have included an ECM that evaluates the potential savings associated with replacing the heaters with high efficiency condensing heaters.

Kitchen Equipment

The building does not have a kitchen.

Plug Load

This building has computers, residential appliances (microwaves, refrigerators, etc.), and printers 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 an 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, metal halide fixtures, CFLs lamps and incandescent lights. The majority of lighting fixtures are 40 watt T-12 fluorescent linear fixtures. There are four exterior metal halides on the roof. Each of them is believed to be about 400W. All of the interior lights are controlled by manual switches. An ECM is included for replacing all for the lighting with LED equivalent and controlled by occupancy sensors was evaluated.

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	Natural Gas
Deliverer	PSE&G	PSE&G
Supplier	PSE&G	PSE&G

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

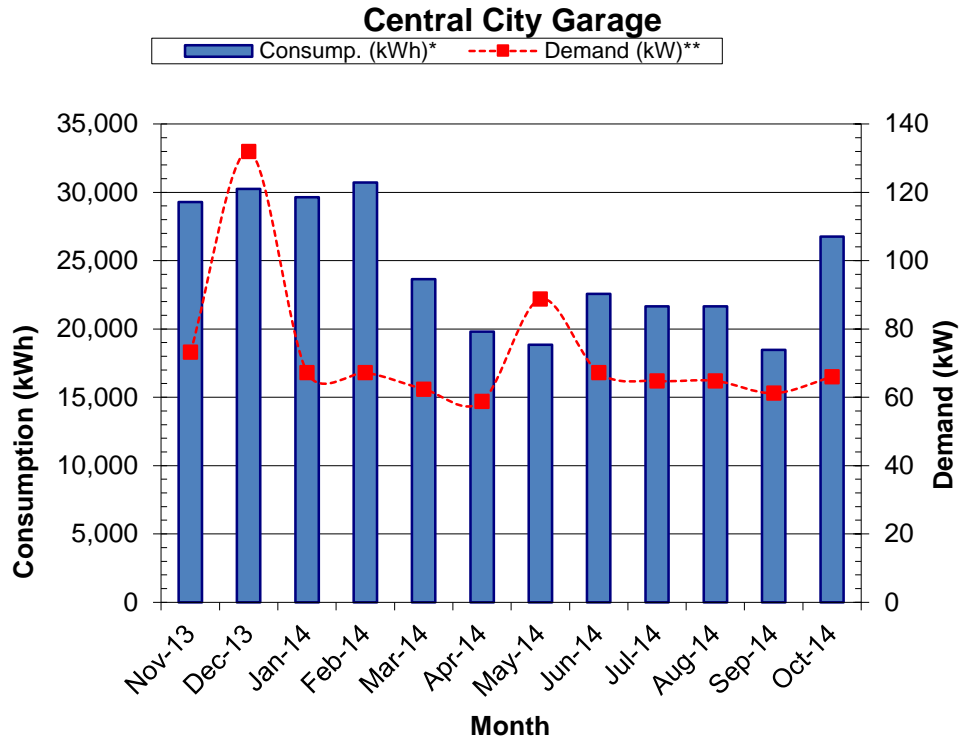
Electric		
Annual Usage	293,280	kWh/yr
Annual Cost	69,907	\$
Blended Rate	0.238	\$/kWh
Peak Demand	132.0	kW
Min. Demand	58.8	kW
Avg. Demand	72.8	kW
Natural Gas		
Annual Usage	39,611	Therms/yr
Annual Cost	45,860	\$
Rate	1.158	\$/therm
Energy Summary		
Building Area	71,874	SF
Energy Usage Intensity (EUI)	69	KBtu/SF/yr
Energy Cost Index (ECI)	1.61	\$/SF/yr
Total Annual Utility Costs	115,767	\$

Blended Rate: Average rate charged determined by the annual cost / annual usage

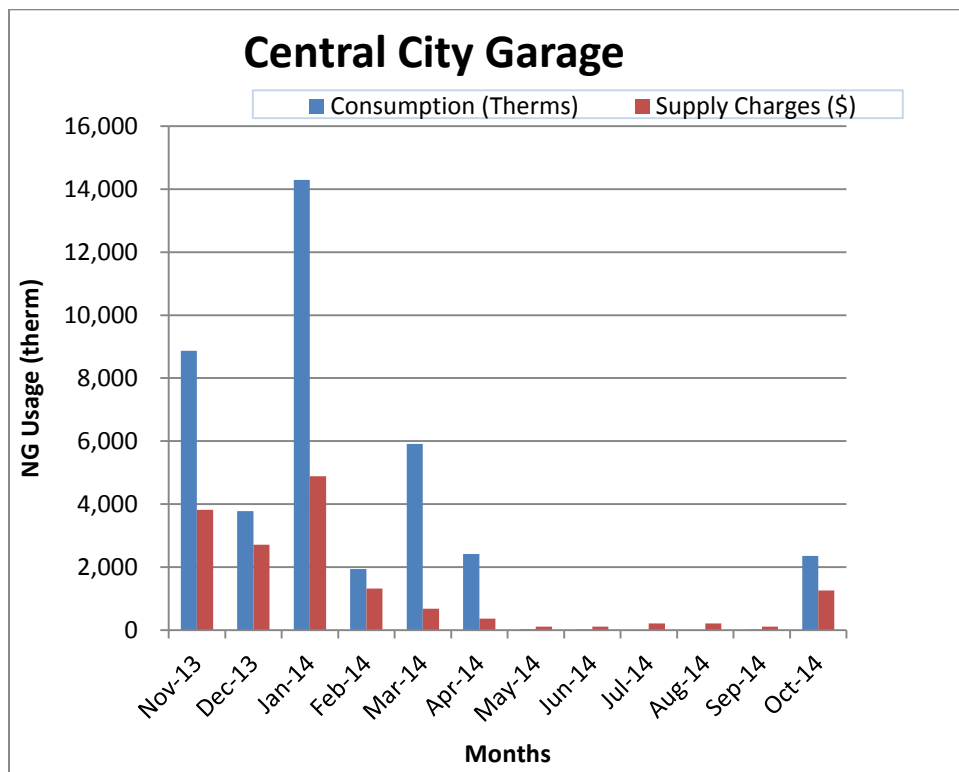
Supply Rate: Actual rate charged for electricity usage in kWh (based on most recent electric bill)

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 is fairly consistent throughout the year. The reduction in the summer months indicates that the air conditioning is not used heavily. The higher usage in the heating season indicates that the usage the HHW pump motors and some electric unit heaters.



The natural gas usage in this building is used for heating and DHW production. The gas usage during the heating season is correlated to winter weather conditions Summer usage is for domestic hot water only and relatively low.

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	Average Rate	NJ Average Rate	
Electricity	\$/kWh	\$0.238	\$0.13	Y
Natural Gas	\$/Therm	\$1.158	\$0.96	Y

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

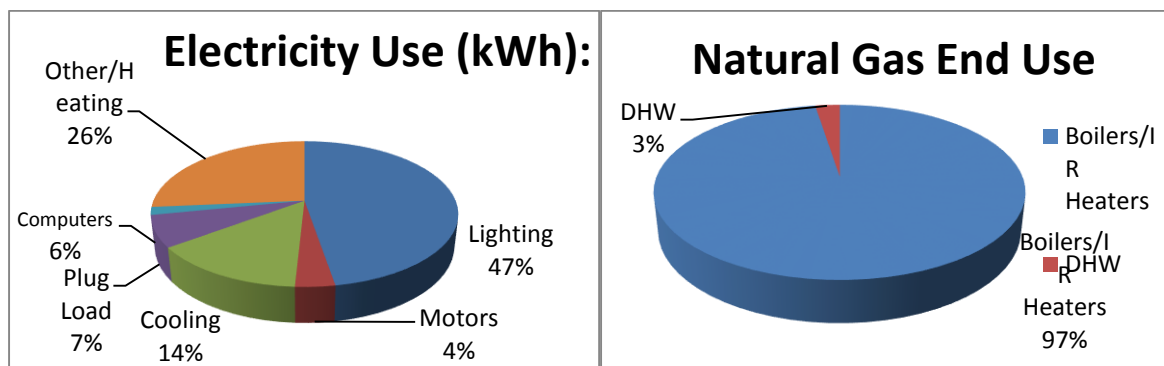
Additional information on selecting a third party energy supplier is available here:

<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)
69	101.6	N/A

The national median site EUI is 68.2 kBtu/ft²/yr and source EUI is 100.4 kBtu/ft²/yr. The building has 1% higher source EUI than the national median source EUI. It is believed that the old boilers and the building envelop contribute to the slightly higher EUI. It is expected that the EUI will be reduced by implementing the measures discussed in this report.

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████████████████████

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 Window Replacement

This measure evaluates the energy savings for replacing the single pane windows in the office section of the building with double pane windows that have better seals and insulation value. Replacement of these windows will result in a reduction of the buildings' heating and cooling loads, therefore resulting in both electric and natural gas savings.

Energy savings for this measure were calculated by estimating the reduction in the heat transfer loss and the infiltration rate through the windows. The U value of the windows will be reduced from 1.13 Btuh/SF/F to 0.50 Btuh/SF/F and the infiltration factor is reduced from 0.30 CFM/LF to 0.15CFM/LF after upgrading the windows to double glazed windows with better seals.

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

ECM-1 Window Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
47,600	0	0	695	1,119	(0.4)	0	42.5	42.5

* 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 the long payback period.

5.2 ECM-2 Replace the Old Boiler with a Condensing Boiler

The office section of the building a central heating hot water system and the garage is majorly heated by infrared heaters with a few unit heaters. The heating hot water is provided by ten old Hydro-therm boilers which are original to the building. Each of the boiler has a rated 240MBH energy input and 80% efficiency. There are high efficiency condensing boilers available that have better efficiencies, therefore, it is suggested one condensing boiler be added to run as the main boiler. 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 Old 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
68,038	0	0	3,300	5,313	1.0	1,320	12.8	12.6

* 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 Install Thermostats on the HHW System

The existing baseboard heaters in the office area are controlled by manual thermostats which are broken and/or not functioning properly. It is suggested that digital programmable thermostats be installed to control the unit heaters and implement a night set-back temperature during unoccupied hours. Savings result from the reduced steam boiler operation.

The cost of implementing this measure includes installing the programmable thermostats, wiring and disconnecting the old thermostats, and the labor cost on doing programming on these new thermostats.

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

ECM-3 Install Thermostats on the HHW System

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
39,096	0	0	2,010	3,237	1.1	0	12.1	12.1

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

This measure is recommended.

5.4 ECM-4 Install Window A/C Units Controller

There are 5 window A/C units in the building which typically, are left on by the occupants when they leave the room.

This ECM evaluates the installation of programmable “smart” timers that interrupt the electrical supply to the window air conditioners when the room is unoccupied. The timers are configurable to operate as a standalone timer or they can be wirelessly interconnected to provide remote temperature control using software.

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

ECM-4 Install Window A/C Units Controller

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
1,500	0	657	0	156	0.6	0	9.6	9.6

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

This measure is recommended.

5.5 ECM-5 Replace the DHW Heaters with Condensing Heaters

Domestic Hot Water is currently produced by a gas fired DHW heater located in the boiler room. The heater has a rated 199.9 MBH heating input and an efficiency of 80%. This ECM evaluates the energy savings associated with replacing the existing DHW heater with a condensing boiler/heat exchanger which has an efficiency of around 96%.

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

ECM-5 Replace the DHW Heaters with Condensing Heaters

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
5,657	0	0	111	179	(0.4)	150	31.6	30.8

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

This measure is recommended.

5.6 ECM-6 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-6 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
37,004	47	100	396	(0.9)	0	93.5	93.5

* 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.

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

This building has 40W T-12 fluorescent lighting, metal halide fixtures, CFLs lamps and incandescent lights. The majority of lighting fixtures are 40 watt T-12 fluorescent linear fixtures. There are four exterior metal halides on the roof. Each of them is believed to be about 400W. 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
109,996	18	66,644	0	15,714	0.6	1,640	7.0	6.9

* 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.

5.8 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
- Repair door seals on office doors and garage doors

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 facility 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 qualify for this program.

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.

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.

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.

The electric demand of this building does not meet the 200kW requirement for P4P 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)
15,812	220

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 –220 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
\$881,200	220	265,932	0	\$34,837	\$66,483	25.3	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.

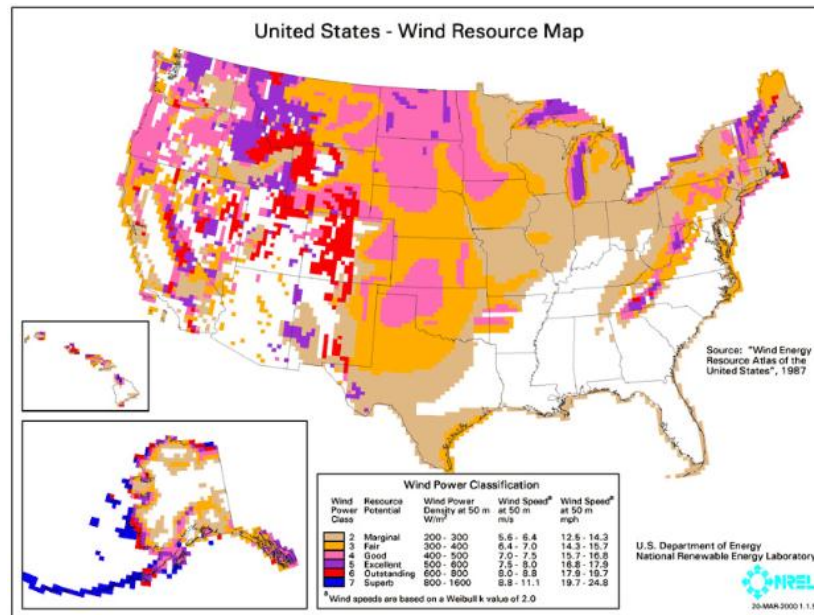
Several options exist for using active solar thermal systems for space heating. The most common method is called a passive solar hot water system involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system described above which requires pumping). 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 November 2013 through December 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
132.0	58.8	72.8	N	N

*the demand is estimated from one month bill

This measure is not recommended due to the lack of enough onsite generation.

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:

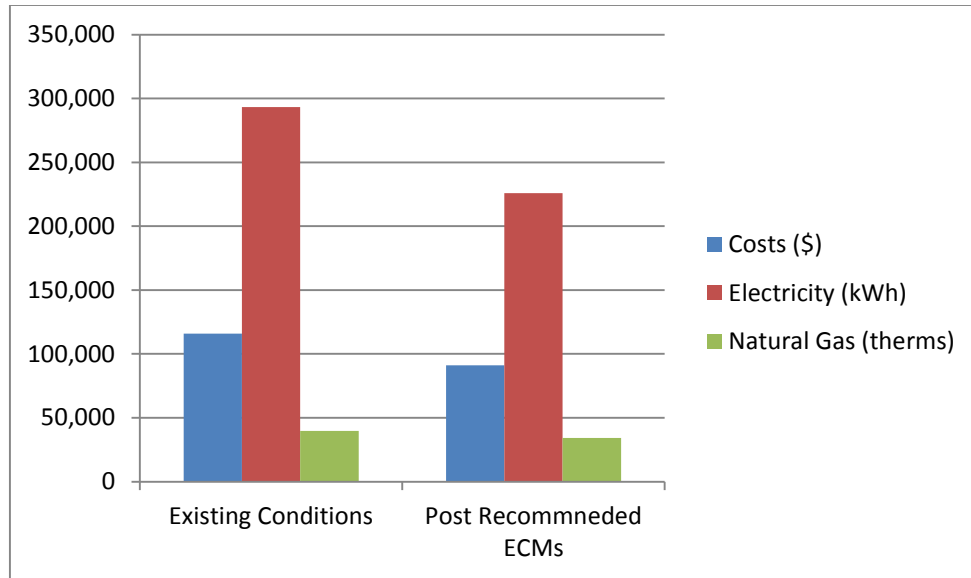
- Replace the Old Boiler with a Condensing Boiler
- Install Thermostats on the HHW System
- Install Window AC Controller
- Replace the DHW Heaters with Condensing Heaters
- Lighting Replacements with LED and add Controls (Occupancy Sensors)

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

Electric Savings (kWh)	Natural Gas Savings (therms)	Total Savings (\$)	Payback (years)
67,301	5,422	\$24,599	9.1

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

	Existing Conditions	Post Recommended ECMs	Percent Savings
Costs (\$)	115,767	91,168	21%
Electricity (kWh)	293,280	225,979	23%
Natural Gas (therms)	39,611	34,189	14%
Site EUI (kbtu/SF/Yr)	69.0	58.3	



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

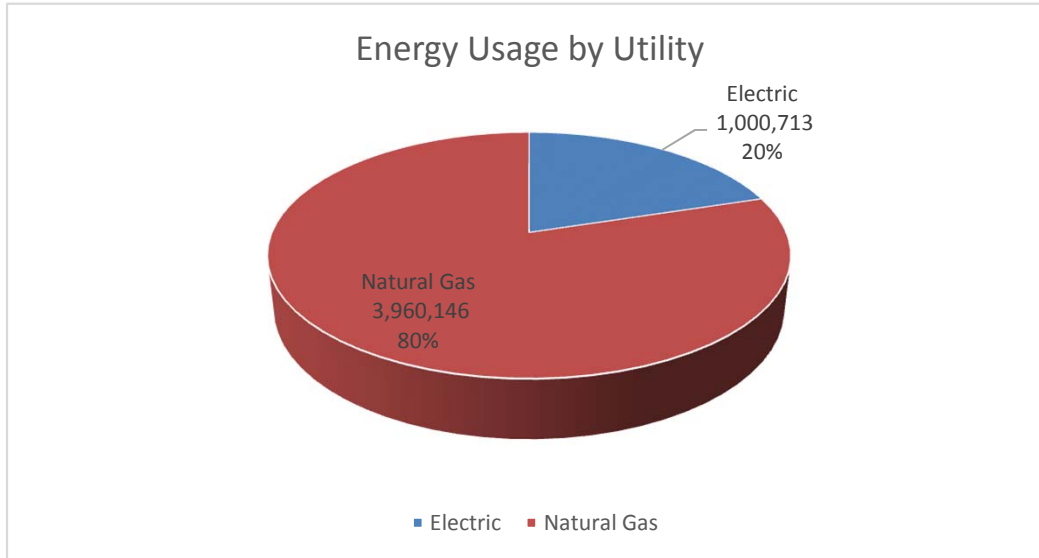
Utility Usage Analysis and Alternate Utility Suppliers

**East Orange NJBPU LGEA
Central City Garage**

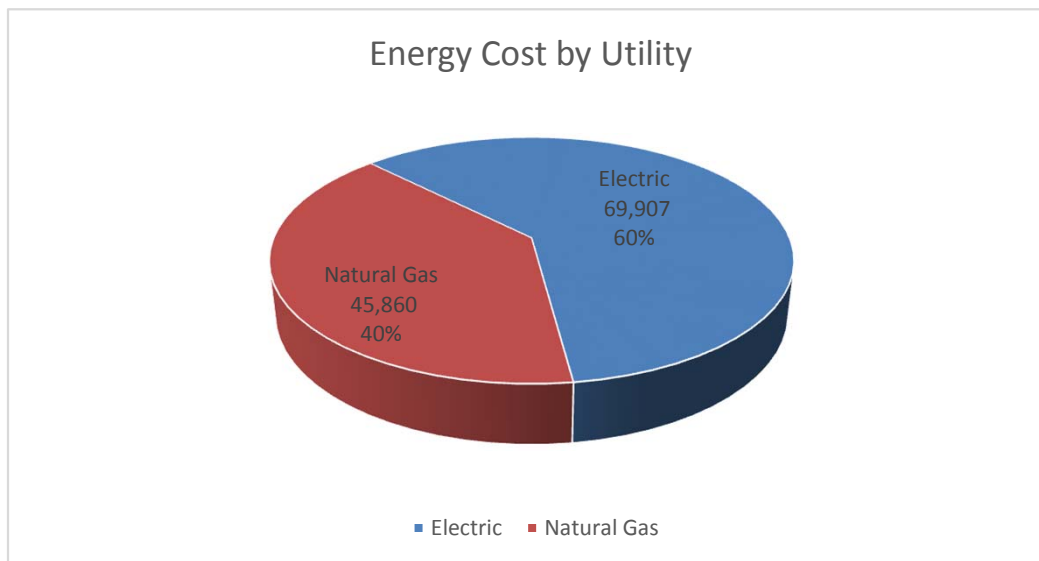
Annual Utilities
12-month Summary

Electric		
Annual Usage	293,280	kWh/yr
Annual Cost	69,907	\$
Blended Rate	0.238	\$/kWh
Peak Demand	132.0	kW
Min. Demand	58.8	kW
Avg. Demand	72.8	kW
Natural Gas		
Annual Usage	39,611	Therms/yr
Annual Cost	45,860	\$
Rate	1.158	\$/therm
Energy Summary		
Building Area	71,874	SF
Energy Usage Intensity (EUI)	69	KBtu/SF/yr
Energy Cost Index (ECI)	1.61	\$/SF/yr
Total Annual Utility Costs	115,767	\$

Utility	KBtu	%
Electric	1,000,713	20%
Natural Gas	3,960,146	80%
	4,960,858	100%



Utility	\$	%
Electric	69,907	60%
Natural Gas	45,860	40%
	115,767	100%



East Orange NJBPU LGEA
Central City Garage

Electric Service

Account No.: 7006679001
Meter No.: 728005591

Delivery: PSE&G
Rate GLP

Month	Consump. (kWh)*	Demand (kW)**	Provider Charges			Usage (kWh) vs. Demand (kW) Charges		Unit Costs				
			Delivery (\$)*	Supplier (\$)	Total (\$)	Consumption (\$)	Demand (\$)	Delivery (\$/kWh)	Supplier (\$/kWh)	Consumption Rate (\$/kWh)	Demand (\$/kW)	Blended Rate (\$/kWh)
November-13	29,280	73	1,317	3,695.14	5,012.24	4426.64	585.60	0.045	0.126	0.151	8.000	0.171
December-13	30,240	132	1,586	4,687.20	6,272.72	5216.72	1056.00	0.052	0.155	0.173	8.000	0.207
January-14	29,640	67	1,252	5,779.80	7,031.34	6493.74	537.60	0.042	0.195	0.219	8.000	0.237
February-14	30,720	67	1,286	5,990.40	7,276.71	6739.11	537.60	0.042	0.195	0.219	8.000	0.237
March-14	23,640	62	1,036	4,609.80	5,646.09	5146.89	499.20	0.044	0.195	0.218	8.000	0.239
April-14	19,800	59	897	3,861.00	4,757.63	4287.23	470.40	0.045	0.195	0.217	8.000	0.240
May-14	18,840	89	1,810	3,202.80	5,012.61	4302.21	710.40	0.096	0.170	0.228	8.000	0.266
June-14	22,560	67	1,666	3,835.20	5,500.92	4963.32	537.60	0.074	0.170	0.220	8.000	0.244
July-14	21,660	65	3,202	3,814.80	7,016.71	6498.31	518.40	0.148	0.176	0.300	8.000	0.324
August-14	21,660	65	3,202	3,549.60	6,751.51	6233.11	518.40	0.148	0.164	0.288	8.000	0.312
September-14	18,480	61	836	3,141.60	3,977.31	3487.71	489.60	0.045	0.170	0.189	8.000	0.215
October-14	26,760	66	1,102	4,549.20	5,650.96	5122.96	528.00	0.041	0.170	0.191	8.000	0.211
Total (All)	293,280	132.00	\$19,190.21	\$50,716.54	\$69,906.75	\$62,917.95	\$6,988.80	\$0.07	\$0.17	\$0.21	\$8.00	\$0.24
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)

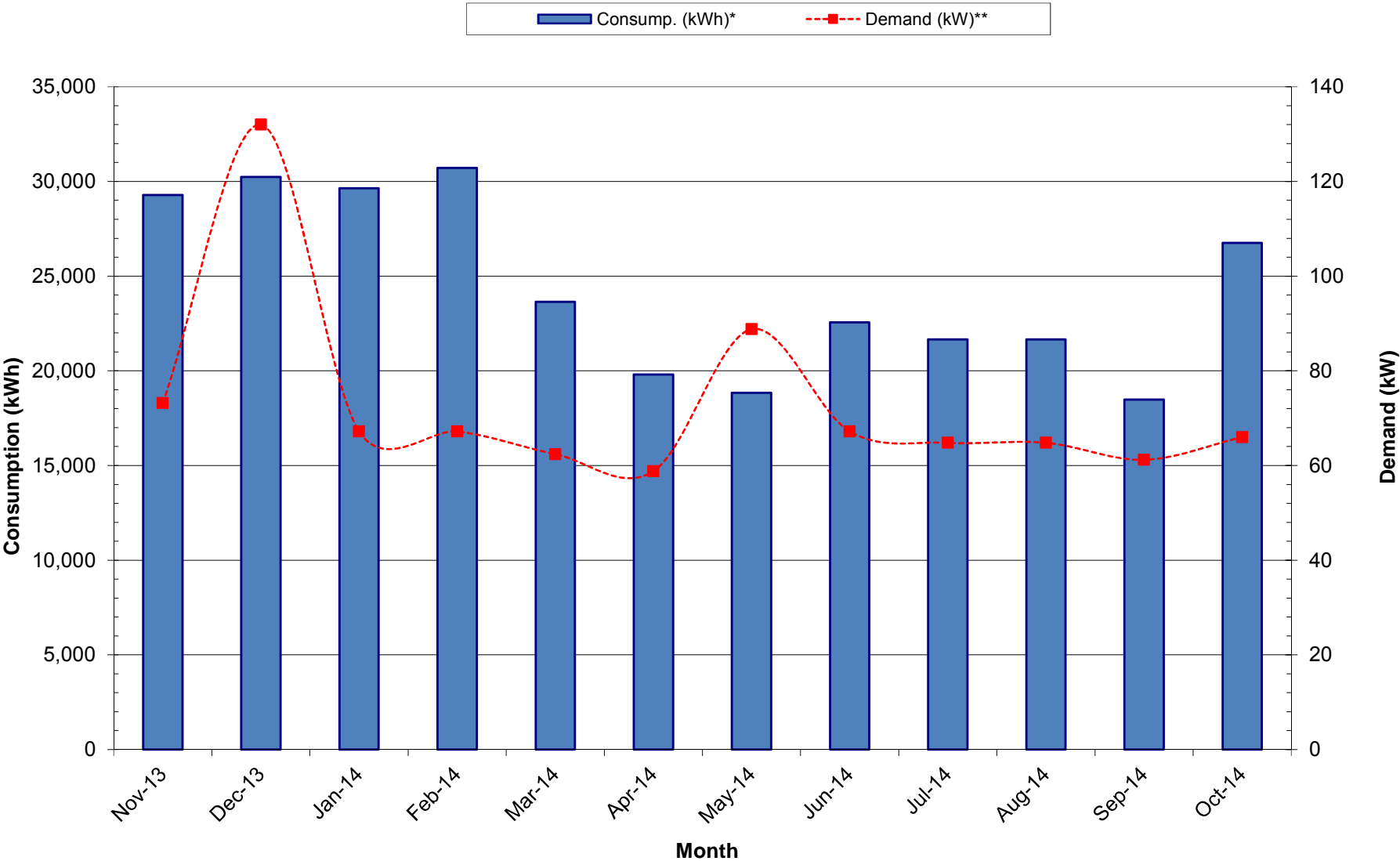
8.) Total Charges (\$) / Consumption (kWh)

* Based on combined numbers provided by client

** Addition of two accounts provided by client

\$21,660.00

Central City Garage



**East Orange NJBPU LGEA
Central City Garage**

Natural Gas Service

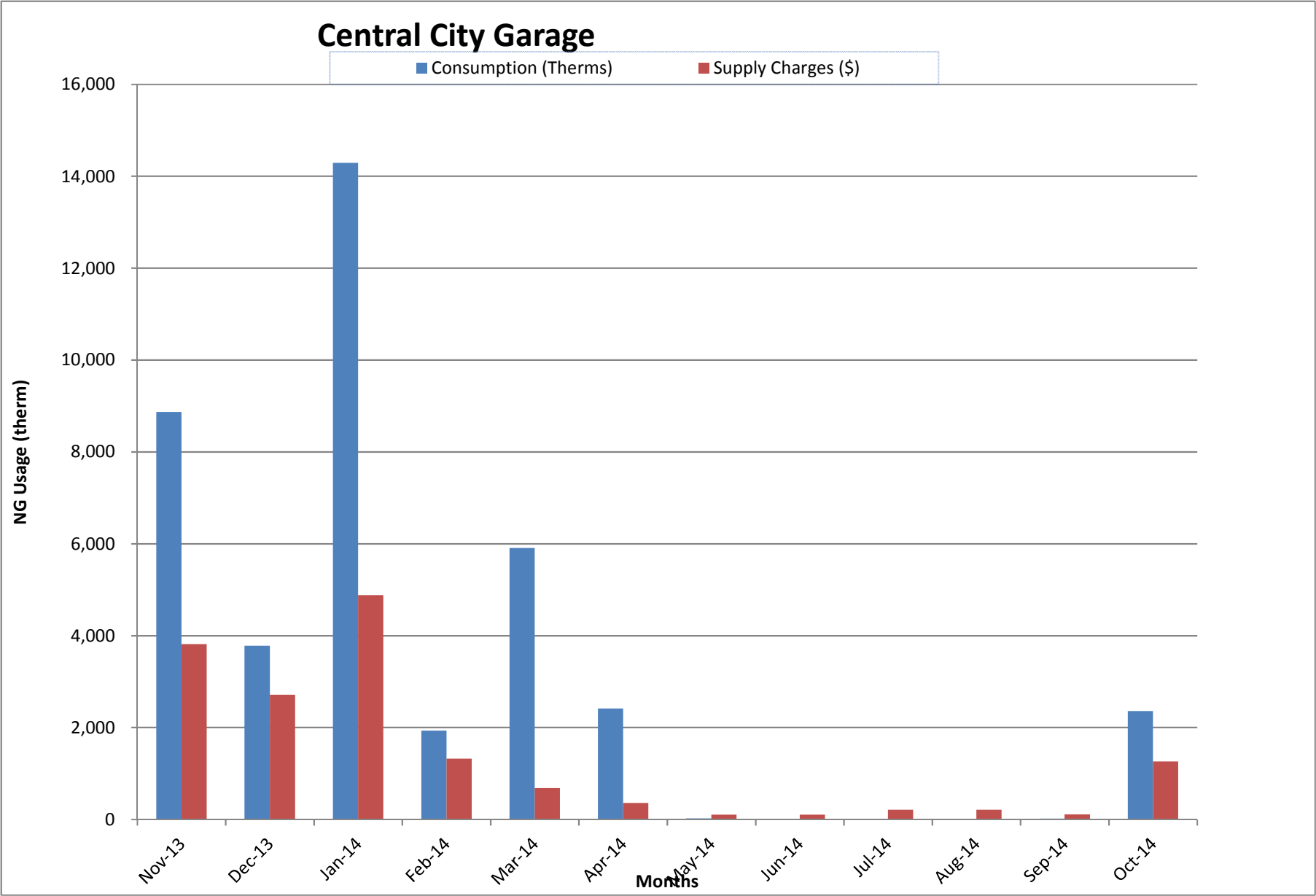
Account No.: 7006679001

Meter No: 1828141

Delivery: PSE&G

Rate LVG

Month	Consumption (Therms)	Delivery Charges (\$)	Supply Charges (\$)	Total Charges (\$)	Rate (\$/Therm)
November-13	8,867.19	3,814.27	5833.04	9,647.31	1.09
December-13	3,778.83	2,712.08	2769.89	5,481.97	1.45
January-14	14,292.10	4,883.48	12759.89	17,643.37	1.23
February-14	1,932.61	1,319.03	1333.50	2,652.53	1.37
March-14	5,908.41	680.15	4076.80	4,756.95	0.81
April-14	2,415.44	357.52	1666.65	2,024.17	0.84
May-14	23.35	104.63	16.11	120.74	5.17
June-14	13.28	103.76	9.16	112.92	8.50
July-14	2.22	206.85	1.53	208.38	93.95
August-14	2.22	206.85	1.53	208.38	93.95
September-14	17.79	105.09	12.28	117.37	6.60
October-14	2,357.47	1,259.69	1626.65	2,886.34	1.22
Total (12 Months)	39,611	\$ 15,753.40	\$ 30,107.04	\$ 45,860.44	\$ 1.16



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 5 th 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 201 Marlton, 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.integrityenergy.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, 2 nd 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 Bedminster, 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
Integrus Energy Services, Inc. 33 Wood Ave, South, Suite 610 Iselin, NJ 08830	(800) 536-0151 www.integrusenergy.com	C/I ACTIVE
Jsynergy, LLC 445 Central Ave. Suite 204 Cedarhurst, NY 11516	(516) 331-2020 Jsynergylc.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. 16 th 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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PSE&G GAS SERVICE TERRITORY
Last Updated 7/21/15

***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

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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 25 th 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
Integrlys Energy Services-Natural Gas, LLC 101 Eisenhower Parkway Suite 300 Roseland, NJ 07068	(800) 536-0151 www.integrlysenergy.com	C/I ACTIVE
Jsynergy LLC 445 Cental Ave. Suite 204 Cedarhurst, NY 11516	(516) 331-2020 www.Jsnergylc.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.pplenenergyplus.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	(855) 427-7827 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

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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
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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.tignaturalgas.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 GASMAR 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
DPW

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	10	Hydro-Therm	N/A	N/A	HHW Boiler	A total of 2,400MBH Energy Output	~80% Efficiency	Boiler Room	The whole building except the garage	1960	-31	Burner replaced in 2010	2016	56	25
HHW Pumps	5	Bell&Gossett	N/A	N/A	HHW Circulation Pumps	one 1/6HP, one 1/4HP, two 1/2HP and One 3HP Motors	N/A	Boiler Room	The whole building except the garage	1990	-1	Burner replaced in 2010	2016	26	25
DHW Heater	2	Bradford White	DM80T1993N	LB33964968	DHW Heater	199.9MBH heating input, and 80 gallon storage	~80% Efficiency	Boiler Room	The whole building	2011	15		2016	5	20
Infrared Heater	9	Omega	Omega II	N/A	Infrared heater for radiant heating	~120MBH each	N/A	Garage	garage	2003	7		2016	18	20
Unit heater	~10	N/A	N/A	N/A	some are electric unit heaters, some are HHW unit heaters and some are gas fired unit heaters	2 ton cooling capacity	N/A	hallway and garage	hallway and garage	2006	10		2016	10	20
Window AC Units	~5	Sunbeam	N/A	N/A	Window AC units	1.5 ton cooling capacity	N/A	offices	offices	2005	9		2016	11	20

	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 Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	Retrofit control device	
41LED	1st Floor Main Entrance	Hallways	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	8736	1,642	NONE	
105LED	Meeting Room	Conference	9	W 32 W F 1	F41LL	32	0.29	SW	3060	881	C-OCC	
41LED	Meeting Room	Conference	38	1B 40 R F 2 (MAG)	F42SS	94	3.57	SW	3060	10,930	C-OCC	
41LED	Office	Offices	6	1B 40 R F 2 (MAG)	F42SS	94	0.56	SW	3060	1,726	C-OCC	
41LED	Break Room	Break/Lunch Rooms	8	1B 40 R F 2 (MAG)	F42SS	94	0.75	SW	3060	2,301	C-OCC	
71LED	Boiler Room	Mechanical Room	5	I 60	I60/1	60	0.30	SW	8736	2,621	NONE	
105LED	Men	Restroom	3	W 32 W F 1	F41LL	32	0.10	SW	3060	294	C-OCC	
105LED	Women	Restroom	2	W 32 W F 1	F41LL	32	0.06	SW	3060	196	C-OCC	
105LED	Hallway	Hallways	6	W 32 W F 1	F41LL	32	0.19	SW	8736	1,677	NONE	
71LED	Storage	Storage Areas	1	I 60	I60/1	60	0.06	SW	3060	184	C-OCC	
105LED	Locker	Locker	5	W 32 W F 1	F41LL	32	0.16	SW	3060	490	NONE	
41LED	Locker	Locker	20	1B 40 R F 2 (MAG)	F42SS	94	1.88	SW	3060	5,753	NONE	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Office	Offices	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	3060	288	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Office	Offices	9	1B 40 R F 2 (MAG)	F42SS	94	0.85	SW	3060	2,589	C-OCC	
41LED	Storage	Storage Areas	130	1B 40 R F 2 (MAG)	F42SS	94	12.22	SW	3060	37,393	C-OCC	
228	Garage	Garage	90	W60CF1	F81EL	60	5.40	SW	3060	16,524	NONE	
228	Garage	Garage	33	W60CF1	F81EL	60	1.98	SW	3060	6,059	NONE	
228	Part shop	Garage	16	W60CF1	F81EL	60	0.96	SW	3060	2,938	NONE	
71LED	Elevator	Hallways	1	I 60	I60/1	60	0.06	SW	8736	524	NONE	
105LED	Men	Restroom	2	W 32 W F 1	F41LL	32	0.06	SW	3060	196	C-OCC	
105LED	Office	Offices	3	W 32 W F 1	F41LL	32	0.10	SW	3060	294	C-OCC	
64LED	Garage	Garage	9	175 MH	MH175/1	215	1.94	SW	3060	5,921	NONE	
71LED	Garage	Garage	8	I 60	I60/1	60	0.48	SW	3060	1,469	NONE	
41LED	Stair	Hallways	2	1B 40 R F 2 (MAG)	F42SS	94	0.19	SW	8736	1,642	NONE	
41LED	Stair	Hallways	1	1B 40 R F 2 (MAG)	F42SS	94	0.09	SW	8736	821	NONE	
231LED	Outdoor	Outdoor Lighting	2	WP400MH1	MH400/1	458	0.92	SW	2550	2,336	NONE	
231LED	Outdoor	Outdoor Lighting	2	WP400MH1	MH400/1	458	0.92	SW	2550	2,336	NONE	
Total			459				38.60			122,967		

APPENDIX C

ECM Calculations

		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	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	Simple Payback Length of time for renovations cost to be recovered
41LED	1st Floor Main Entrance	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	8736	1,642	2	STLED4	STLED4	40	0.1	NONE	8,736	699	943	0.1	\$ 208.50	\$ 713.40	\$ -	3.4	3.4
105LED	Meeting Room	9	W 32 W F 1	F41LL	32	0.3	SW	3060	881	9	4 ft LED Tube	200732x1	15	0.1	C-0CC	2,142	289	592	0.2	\$ 139.03	\$ 870.08	\$ 20	6.3	6.1
41LED	Meeting Room	38	1B 40 R F 2 (MAG)	F42SS	94	3.6	SW	3060	10,930	38	STLED4	STLED4	40	1.5	C-0CC	2,142	3,256	7,674	2.1	\$ 1,808.63	\$ 13,689.60	\$ 20	7.6	7.6
41LED	Office	6	1B 40 R F 2 (MAG)	F42SS	94	0.6	SW	3060	1,726	6	STLED4	STLED4	40	0.2	C-0CC	2,142	514	1,212	0.3	\$ 285.57	\$ 2,275.20	\$ 20	8.0	7.9
41LED	Break Room	8	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,301	8	STLED4	STLED4	40	0.3	C-0CC	2,142	685	1,616	0.4	\$ 380.76	\$ 2,988.60	\$ 20	7.8	7.8
71LED	Boiler Room	5	I 60	I60I	60	0.3	SW	8736	2,621	5	LED15W	LED15W	15	0.1	NONE	8,736	655	1,966	0.2	\$ 434.38	\$ 33.75	\$ -	0.1	0.1
105LED	Men	3	W 32 W F 1	F41LL	32	0.1	SW	3060	294	3	4 ft LED Tube	200732x1	15	0.0	C-0CC	2,142	96	197	0.1	\$ 46.34	\$ 380.03	\$ 20	8.2	7.8
105LED	Women	2	W 32 W F 1	F41LL	32	0.1	SW	3060	196	2	4 ft LED Tube	200732x1	15	0.0	C-0CC	2,142	64	132	0.0	\$ 30.90	\$ 298.35	\$ 20	9.7	9.0
105LED	Hallway	6	W 32 W F 1	F41LL	32	0.2	SW	8736	1,677	6	4 ft LED Tube	200732x1	15	0.1	NONE	8,736	786	891	0.1	\$ 196.92	\$ 490.05	\$ -	2.5	2.5
71LED	Storage	1	I 60	I60I	60	0.1	SW	3060	184	1	LED15W	LED15W	15	0.0	C-0CC	2,142	32	151	0.0	\$ 36.13	\$ 141.75	\$ 20	3.9	3.4
105LED	Locker	5	W 32 W F 1	F41LL	32	0.2	SW	3060	490	5	4 ft LED Tube	200732x1	15	0.1	NONE	3,060	230	260	0.1	\$ 62.78	\$ 408.38	\$ -	6.5	6.5
41LED	Locker	20	1B 40 R F 2 (MAG)	F42SS	94	1.9	SW	3060	5,753	20	STLED4	STLED4	40	0.8	NONE	3,060	2,448	3,305	1.1	\$ 797.69	\$ 7,134.00	\$ -	8.9	8.9
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Office	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	3060	288	1	STLED4	STLED4	40	0.0	C-0CC	2,142	86	202	0.1	\$ 47.60	\$ 491.70	\$ 20	10.3	9.9
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Office	9	1B 40 R F 2 (MAG)	F42SS	94	0.8	SW	3060	2,589	9	STLED4	STLED4	40	0.4	C-0CC	2,142	771	1,818	0.5	\$ 428.36	\$ 3,345.30	\$ 20	7.8	7.8
41LED	Storage	130	1B 40 R F 2 (MAG)	F42SS	94	12.2	SW	3060	37,393	130	STLED4	STLED4	40	5.2	C-0CC	2,142	11,138	26,255	7.0	\$ 6,187.43	\$ 46,506.00	\$ 20	7.5	7.5
228	Garage	90	W60CF1	F81EL	60	5.4	SW	3060	16,524	90	W60CF1	F81EL	60	5.4	NONE	3,060	16,524	-	0.0	\$ -	\$ -	\$ -	-	-
228	Garage	33	W60CF1	F81EL	60	2.0	SW	3060	6,059	33	W60CF1	F81EL	60	2.0	NONE	3,060	6,059	-	0.0	\$ -	\$ -	\$ -	-	-
228	Part shop	16	W60CF1	F81EL	60	1.0	SW	3060	2,938	16	W60CF1	F81EL	60	1.0	NONE	3,060	2,938	-	0.0	\$ -	\$ -	\$ -	-	-
71LED	Elevator	1	I 60	I60I	60	0.1	SW	8736	524	1	LED15W	LED15W	15	0.0	NONE	8,736	131	393	0.0	\$ 86.88	\$ 6.75	\$ -	0.1	0.1
105LED	Men	2	W 32 W F 1	F41LL	32	0.1	SW	3060	196	2	4 ft LED Tube	200732x1	15	0.0	C-0CC	2,142	64	132	0.0	\$ 30.90	\$ 298.35	\$ 20	9.7	9.0
105LED	Office	3	W 32 W F 1	F41LL	32	0.1	SW	3060	294	3	4 ft LED Tube	200732x1	15	0.0	C-0CC	2,142	96	197	0.1	\$ 46.34	\$ 380.03	\$ 20	8.2	7.8
64LED	Garage	9	175 MH	MH175I	215	1.9	SW	3060	5,921	9	BAYLED78W	BAYLED78W	93	0.8	NONE	3,060	2,561	3,360	1.1	\$ 810.98	\$ 7,597.76	\$ 900	9.4	8.3
71LED	Garage	160	I 60	I60I	60	0.5	SW	3060	8,069	160	LED15W	LED15W	15	0.1	NONE	3,060	367	1,102	0.4	\$ 264.00	\$ 264.00	\$ 15	0.2	0.2
41LED	Stair	2	1B 40 R F 2 (MAG)	F42SS	94	0.2	SW	8736	1,642	2	STLED4	STLED4	40	0.1	NONE	8,736	699	943	0.1	\$ 208.50	\$ 713.40	\$ -	3.4	3.4
41LED	Stair	1	1B 40 R F 2 (MAG)	F42SS	94	0.1	SW	8736	821	1	STLED4	STLED4	40	0.0	NONE	8,736	349	104.25	\$ 356.70	\$ -	\$ -	\$ -	3.4	3.4
231LED	Outdoor	2	WP400MH1	MH400I	458	0.9	SW	2550	2,336	2	WPLED2T78	WPLED2T78	91	0.2	NONE	2,550	464	1,872	0.7	\$ 463.52	\$ 2,048.38	\$ 200	4.4	4.0
231LED	Outdoor	2	WP400MH1	MH400I	458	0.9	SW	2550	2,336	2	WPLED2T78	WPLED2T78	91	0.2	NONE	2,550	464	1,872	0.7	\$ 463.52	\$ 2,048.38	\$ 200	4.4	4.0
															0	#N/A							#VALUE!	
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															0	#N/A							#VALUE!	
S	Total	459				38.6			122,967	459				20.7			56,323		17.9	15,714	109,996	\$1,640		
S																								
S																								
S																								

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 71,874	Annual Utility Cost		
\$	0.238	\$/kWh blended			Electric	Natural Gas	Fuel Oil
\$	0.210	\$/kWh supply	293,280		\$ 69,907	\$ 45,860	
\$	8.00	\$/kW	132.0				
\$	1.61	\$/Therm	39,611				
\$	5.00	\$/kgals					
		\$/Gal					

water

Recommend? Y or N	Garage DPW																						
		Item	Savings					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					ROI	NPV	IRR	
			kW	kWh	therms	No. 2 Oil gal	Water kgal								\$	kW	kWh	therms	kgal/yr				\$
N	ECM-1	Window Replacement	0.0	0	695	0	0	1,119	\$ 47,600	42.5	25	3.7	\$ -	N	42.5	0.0	0	17,373	0	\$ 27,971	(0.4)	(\$28,118)	-3.7%
Y	ECM-2	Replace the Old Boiler with a Condensing Boiler	0.0	0	3,300	0	0	5,313	\$ 68,038	12.8	25	17.6	\$ 1,320	N	12.6	0.0	0	82,502	0	\$ 132,828	1.0	\$25,800	6.2%
Y	ECM-3	Install Thermostats on the HHW System	0.0	0	2,010	0	0	3,237	\$ 39,096	12.1	25	10.7	\$ -	N	12.1	0.0	0	50,259	0	\$ 80,917	1.1	\$17,265	6.6%
Y	ECM-4	Install Window AC Controller	0.0	657	0	0	0	156	\$ 1,500	9.6	15	0.3	\$ -	N	9.6	0.0	9,850	0	\$ 2,344	0.6	\$366	6.2%	
Y	ECM-5	Replace the DHW Heaters with Condensing Heaters	0.0	0	111	0	0	179	\$ 5,657	31.6	20	0.6	\$ 150	N	30.8	0.0	0	2,222	0	\$ 3,578	(0.4)	(\$2,846)	-3.8%
N	ECM-6	Replace Old Plumbing Fixtures with Low Flow Plumbing Fixtures	0.0	0	100	0	47	396	\$ 37,004	93.5	10	0.5	\$ -	N	93.5	0.0	0	998	471	\$ 3,959	(0.9)	(\$33,627)	-28.2%
Y	ECM-L1	Lighting Replacements with Controls (Occupancy Sensors)	17.9	66,644	0	0	0	15,714	109,996	7.0	10	28.0	\$ 1,640	N	6.9	179.0	666,440	0	0	\$ 175,797	0.6	\$25,685	7.4%
Total			17.9	67,300.7	6,216.3	0.0	47.1	26,113.4	308,891.3	11.8	18.6	61.4	3,110.0		11.7	179	676,290.0	153,354.4	470.6	427,394.5	0.4	4,525.4	5.0%
Recommended Measures (highlighted green above)			17.9	67,301	5,422	0.0	0.0	24,599	224,287	9.1	19.0	57.2	3,110.0	0.0	9.0	179.0	676,290.0	134,983.6	0.0	395,464.6	0.8	66,269.9	8.9%
% of Existing			14%	23%	14%	0	0																

City:		Newark, NJ					
Occupied Hours/Week		40					
		Building	Auditorium	Gymnasium	Library	Classrooms	
		Operating	Occupied	Occupied	Occupied	Occupied	
Temp	Enthalpy h (Btu/lb)	Bin Hours	Hours	Hours	Hours	Hours	Hours
102.5							
97.5	35.4	6	1	0	0	0	0
92.5	37.4	31	7	0	0	0	0
87.5	35.0	131	31	0	0	0	0
82.5	33.0	500	119	0	0	0	0
77.5	31.5	620	148	0	0	0	0
72.5	29.9	664	158	0	0	0	0
67.5	27.2	854	203	0	0	0	0
62.5	24.0	927	221	0	0	0	0
57.5	20.3	600	143	0	0	0	0
52.5	18.2	730	174	0	0	0	0
47.5	16.0	491	117	0	0	0	0
42.5	14.5	656	156	0	0	0	0
37.5	12.5	1,023	244	0	0	0	0
32.5	10.5	734	175	0	0	0	0
27.5	8.7	334	80	0	0	0	0
22.5	7.0	252	60	0	0	0	0
17.5	5.4	125	30	0	0	0	0
12.5	3.7	47	11	0	0	0	0
7.5	2.1	34	8	0	0	0	0
2.5	1.3	1	0	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	9,454 Hrs
Weighted Avg	2 F
Avg	25 F

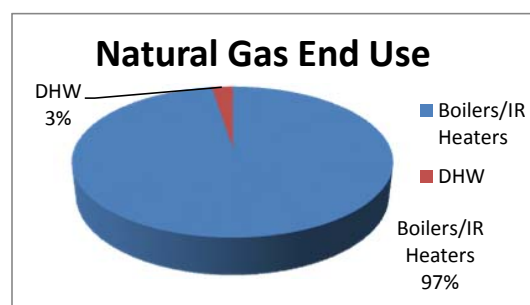
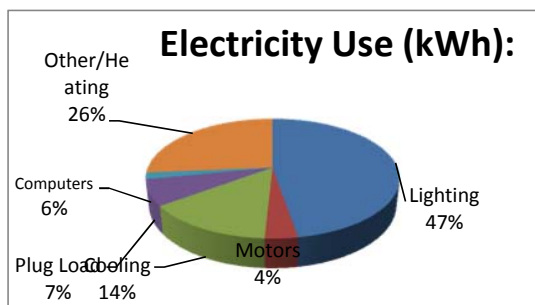
Cooling	
Hours	4,333 Hrs
Weighted Avg	68 F
Avg	78 F

City of East Orange
 CHA Project Number: 30993
 Garage DPW

Utility End Use Analysis		
Electricity Use (kWh):		Notes/Comments:
293,280	Total	Based on utility analysis
135,000	Lighting	From Lighting Calculations
10,000	Motors	Estimated
40,000	Cooling	Calculated from Cooling Capacity
20,000	Plug Load	Estimated
5,000	Computers	Estimated
75,280	Other/Heating	Remaining
Natural Gas Use (Therms):		Notes/Comments:
39,611	Total	Based on utility analysis
38,611	Boilers/IR Heaters	
1,000	DHW	Based on utility analysis

46%
 3%
 14%
 7%
 2%
 26%

97%
 3%



City of East Orange
CHA Project Number: 30993
Garage DPW

Note: pricing is for energy calculations only -do not use for procurement

ECM-1 Window Replacement

Existing: The windows in this building are still single pane windows which needs to be upgraded to reduce heating lo
Proposed: Replace single pane windows with double pane window

Linear Feet of Windows	816.0 LF	Cooling System Efficiency	0 kW/ton	Heating System Efficiency	78%
Area of Windows	336.0 SF	Ex Occupied Cing Temp.	74 °F	Heating On Temp.	60 °F
Existing Infiltration Factor	0.30 cfm/LF	Ex Unoccupied Cing Temp.	80 °F	Ex Occupied Htg Temp.	70 °F
Proposed Infiltration Factor	0.15 cfm/LF	Cooling Occ Enthalpy Setpoint	27.5 Btu/lb	Ex Unoccupied Htg Temp.	65 °F
Existing U Value	1.13 Btuh/SF°F	Cooling Unocc Enthalpy Setpoint	27.5 Btu/lb	Electricity	\$ 0.238 \$/kWh
Proposed U Value	0.50 Btuh/SF°F			Natural Gas	\$ 1.61 \$/therm

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY		
					Occupied	Unoccupied	Occupied	Unoccupied					
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Air	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Panel Infiltration & Heat Load BTUH	Panel Infiltration & Heat Load BTUH	Panel Infiltration & Heat Load BTUH	Panel Infiltration & Heat Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy Therms	Proposed Heating Energy Therms
A			B	C	D	E	F	G	H	I	J	K	L
102.5	50.1		0	0	0	-35,717	-33,439	-17,236	-16,228	0	0	0	0
97.5	42.5		6	2	4	-25,446	-23,168	-12,210	-11,202	0	0	0	0
92.5	39.5		45	16	29	-20,243	-17,965	-9,718	-8,710	0	0	0	0
87.5	36.6		146	52	94	-15,150	-12,872	-7,280	-6,272	0	0	0	0
82.5	34.0		298	106	192	-10,388	-8,110	-5,008	-4,000	0	0	0	0
77.5	31.6		476	170	306	-5,845	0	-2,846	0	0	0	0	0
72.5	29.2		662	237	426	0	0	0	0	0	0	0	0
67.5	27.0		740	264	476	0	0	0	0	0	0	0	0
62.5	24.5		765	273	492	0	0	0	0	0	0	0	0
57.5	21.4		733	262	471	8,051	4,830	3,752	2,251	0	0	56	26
52.5	18.7		668	239	430	11,271	8,051	5,253	3,752	0	0	79	37
47.5	16.2		659	235	424	14,491	11,271	6,754	5,253	0	0	105	49
42.5	14.4		685	245	441	17,712	14,491	8,255	6,754	0	0	137	64
37.5	12.6		739	264	475	20,932	17,712	9,756	8,255	0	0	179	83
32.5	10.7		717	256	461	24,152	20,932	11,257	9,756	0	0	203	95
27.5	8.6		543	194	349	27,373	24,152	12,758	11,257	0	0	176	82
22.5	6.8		318	114	205	30,593	27,373	14,259	12,758	0	0	116	54
17.5	5.5		245	88	158	33,813	30,593	15,760	14,259	0	0	100	46
12.5	4.1		156	56	100	37,034	33,813	17,261	15,760	0	0	70	33
7.5	2.6		92	33	59	40,254	37,034	18,762	17,261	0	0	45	21
2.5	1.0		36	13	23	43,474	40,254	20,263	18,762	0	0	19	9
-2.5	0.0		19	7	12	46,695	43,474	21,764	20,263	0	0	11	5
-7.5	-1.5		8	3	5	49,915	46,695	23,265	21,764	0	0	5	2
TOTALS			8,760	3,129	5,631					0	0	1,302	607

Existing Panel Infiltration	245 cfm	Savings	695 Therms	\$ 1,119
Existing Panel Heat Transfer	380 Btuh/°F		0 kWh	\$ -
Proposed Panel Infiltration	122 cfm			\$ 1,119
Proposed Panel Heat Transfer	168 Btuh/°F			

Panel ID	Location	Quantity	Width (ft)	Height (ft)	Linear Feet (LF)	Area (SF)	Infiltration Rate (CFM/LF)	U Value (Btuh/SF°F)	Infiltration (CFM)	Heat Transfer (Btuh/°F)
1	whole building	48	2	2	384.0	192.0	0.3	1.13	115.2	217.0
1	whole building	72	2	1	432.0	144.0	0.3	1.13	129.6	162.7
Total		120	4	3	816	336	0.30	1.13	244.8	379.7

*the number of the windows suitable for replacement is estimated based on facility staff and field observation. The final counts should be conducted by the window contractor for the actual replacement amount

Multipliers	
Material:	1.10
Labor:	1.35
Equipment:	1.10

ECM-1 Window Replacement - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Window Replacement	336	sqft	\$ 65	\$ 40	\$ -	\$ 21,840	\$ 13,440	\$ -	\$ 35,280	Vendor Est per SF

Cost estimated are for Energy Savings only- do not use for procurement

\$ 35,280	Subtotal
\$ 12,348	35% Contingency
\$ 47,600	Total

City of East Orange
CHA Project Number: 30993
Garage DPW

ECM-2 Replace the Old Boiler with a Condensing Boiler

Description: This ECM evaluates replacing the existing boiler with a high efficiency condensing boiler.

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	\$ 1.61	/ Therm	Natural Gas
Baseline Fuel Cost		/ 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	2,059,404	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	2,059,404	btu/hr	
Efficiency	90%		
SAVINGS			
Fuel Savings	3,300	therms	NJ Protocols Calculation
Fuel Cost Savings	\$ 5,313		

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

Garage DPW

ECM-2 Replace the Old Boiler with a Condensing Boiler-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.		
500 MBH NG Condensing Boiler	2	EA	\$ 15,500	\$ 3,800		\$ 31,837	\$ 9,470	\$ -	\$ 41,307	Vendor Estimate
Flue Installation	2	LS	\$ 500.0	\$ 500.0		\$ 1,027	\$ 1,246	\$ -	\$ 2,273	Estimated
controls	2	EA	\$ 500.0	\$ 500.0		\$ 1,027	\$ 1,246	\$ -	\$ 2,273	Estimated
Miscellaneous Electrical	2	LS	\$ 500.0	\$ 500.0		\$ 1,027	\$ 1,246	\$ -	\$ 2,273	Estimated
Miscellaneous HW Piping	2	LS	\$ 500.0	\$ 500.0		\$ 1,027	\$ 1,246	\$ -	\$ 2,273	Estimated
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	

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

\$ 50,399	Subtotal
\$ 17,640	35% Contingency
\$ 68,038	Total

ECM-3 Install Thermostats on the HHW System

Description: This ECM evaluates installing thermostat control valves on the fan coil units and unit heaters to have more accurate control on the room temperature (temeprature setback at night) and reduce energy usage

Day Setback			Nighttime Setback			
EXISTING CONDITIONS			EXISTING CONDITIONS			
Heating			Heating			
Heating Season Facility Temp	78	F	Th	Heating Season Facility Temp	78	F
Weekly Occupied Hours	40	hrs	H	Weekly Occupied Hours	40	hrs
Heating Season Setback Temp	72	F	Sh	Heating Season Setback Temp	68	F
Heating Season % Savings per	1%		Ph	Heating Season % Savings per	1%	
Annual Boiler Capacity	1,930,550	Mbtu/yr		Annual Boiler Capacity	1,930,550	Mbtu/yr
Connected Heating Load	2,059,404	Btu/hr	Caph	Connected Heating Load Capacity	2,059,404	Btu/hr
Equivalent Full Load Heating	900	hrs	EFLHh	Equivalent Full Load Heating Hours	500	hrs
Heating Equipment Efficiency	78%		AFUEh	Heating Equipment Efficiency	78%	
S A V I N G S			S A V I N G S			
Natural Gas Savings	1,044	Therms ³		Natural Gas Savings	967	Therms ³
Cooling Electricity Savings	0	kWh		Cooling Electricity Savings	0	kWh

\$0.24 \$/kWh Blended \$1.61 \$/Therm	COMBINED SAVINGS	
	Natural Gas Savings	2,010 Therms
	Cooling Electricity Savings	0 kWh
	Total Cost Savings	\$ 3,237
	Estimated Total Project Cost	\$ 39,096
	Simple Payback	12.1 Yrs

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

Algorithms

Cooling Energy Savings (kWh) = $((T_c * (H+5) + S_c * (168 - (H+5))) / 168) * T_c * (P_c * Cap_{hp} * 12 * EFLH_c / EER_{hp})$

Heating Energy Savings (kWh) = $((T_h * (H+5) + S_h * (168 - (H+5))) / 168) - T_h * (P_h * Cap_{hp} * 12 * EFLH_h / EER_{hp})$

Heating Energy Savings (Therms) = $(T_h - (T_h * (H+5) + S_h * (168 - (H+5))) / 168) * (P_h * Cap_{hp} * EFLH_h / AFUE_h / 100,000)$

Definition of Variables

T_h = Heating Season Facility Temp. (°F)

T_c = Cooling Season Facility Temp. (°F)

S_h = Heating Season Setback Temp. (°F)

S_c = Cooling Season Setup Temp. (°F)

H = Weekly Occupied Hours

Cap_{hp} = Connected load capacity of heat pump/AC (Tons) – Provided on Application.

Cap_h = Connected heating load capacity (Btu/hr) – Provided on Application.

$EFLH_c$ = Equivalent full load cooling hours

$EFLH_h$ = Equivalent full load heating hours

P_h = Heating season percent savings per degree setback

P_c = Cooling season percent savings per degree setup

$AFUE_h$ = Heating equipment efficiency – Provided on Application.

EER_{hp} = Heat pump/AC equipment efficiency – Provided on Application

Occupancy Controlled Thermostats

Component	Type	Value	Source
T_h	Variable		Application
T_c	Variable		Application
S_h	Fixed	$T_h - 5^\circ$	
S_c	Fixed	$T_c + 5^\circ$	
H	Variable		Application; Default of 56 hrs/week
Cap_{hp}	Variable		Application
Cap_h	Variable		Application
$EFLH_c$	Fixed	381	1
$EFLH_h$	Fixed	900	PSE&G
P_h	Fixed	3%	2
P_c	Fixed	6%	2
$AFUE_h$	Variable		Application
EER_{hp}	Variable		Application

Sources:

1. JCP&L metered data from 1995-1999
2. ENERGY STAR Products website

City of East Orange
CHA Project Number: 30993
Garage DPW

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.00

ECM-3 Install Thermostats on the HHW System - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						\$ -	\$ -	\$ -	\$ -	
Boiler Controller	1	ea	\$ 10,000	\$ 15,000		\$ 10,270	\$ 18,690	\$ -	\$ 28,960	Estimated
						\$ -	\$ -	\$ -	\$ -	

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

\$ 28,960	Subtotal
\$ 10,136	35% Contingency
\$ 39,096	Total

City of East Orange
CHA Project Number: 30993
Garage DPW

EQUIPMENT	AREA/EQUIPMENT SERVED	COOLING CAPACITY (btu/h)		
Window AC	Office	90,000	18,000	5 units
Total btu/h of all window A/C Units:		90,000	btu/h	5 unitss

ECM-4 Install Window AC Controller

ECM Description : Window A/C units are currently controlled manually by the occupants and are not turned off when the room is unoccupied. This ECM evaluates implementation of a digital timer device that will automatically turn the window A/C unit off at a preset time .

ASSUMPTIONS		Comments
Electric Cost	\$0.238 / kWh	
Average run hours per Week	49 Hours	
Space Balance Point	55 F	
Space Temperature Setpoint	72 deg F	Setpoint.
BTU/Hr Rating of existing DX equipment	90,000 Btu / Hr	Total BTU/hr of DX cooling equipment to be replaced.
Average EER	11.0	
Existing Annual Electric Usage	1,845 kWh	

Item	Value	Units	Comments
Proposed Annual Electric Usage	1,189	kWh	Unit will cycle on w/ temp of room. Possible operating time shown below

ANNUAL SAVINGS	
Annual Electrical Usage Savings	657 kWh
Annual Cost Savings	\$156
Total Project Cost	\$1,500
Simple Payback	10 years

OAT - DB Bin Temp F	Annual Hours	Existing Hours of Operation	Proposed % of time of operation	Proposed hrs of Operation
102.5	0	0	100%	0
97.5	6	5	100%	5
92.5	31	24	100%	24
87.5	131	90	87%	78
82.5	500	289	73%	212
77.5	620	294	60%	176
72.5	664	245	47%	114
67.5	854	0	0%	0
62.5	927	0	0%	0
57.5	600	0	0%	0
52.5	730	0	0%	0
47.5	491	0	0%	0
42.5	656	0	0%	0
37.5	1,023	0	0%	0
32.5	734	0	0%	0
27.5	334	0	0%	0
22.5	252	0	0%	0
17.5	125	0	0%	0
12.5	47	0	0%	0
7.5	34	0	0%	0
2.5	1	0	0%	0
-2.5	5,027	0	0%	0
-7.5	0	0	0%	0
Total	13,787	947	64%	610

City of East Orange
CHA Project Number: 30993
Garage DPW

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-4 Install Window AC Controller - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						0	\$ -	\$ -	\$ -	
Window AC Controller	5	EA	\$ 100	\$ 100	\$ -	513.5	\$ 623	\$ -	\$ 1,137	Estimated
						\$ -	\$ -	\$ -	\$ -	

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

\$ 1,137	Subtotal
\$ 398	35% Contingency
\$ 1,500	Total

City of East Orange
CHA Project Number: 30993
Garage DPW

ECM-5 Replace the DHW Heaters with Condensing Heaters

Description: This ECM evaluates the energy savings associated with replacing the existing DHW heater with a condensing heater

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	83	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	100,000	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	80%		Per manufacturer nameplate
Total Annual Hot Water Demand (w/ standby losses)	80,000	MBTU/yr	
Existing Tank Size	80	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	°F	Per building personnel
Room Temperature	72	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	1.2	MBH	
Annual Standby Hot Water Load	10,549	MBTU/yr	
New Tank Size	80	Gallons	Based on condensing DHW Heater info from internet
Hot Water Piping System Capacity	5	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	140	°F	
Room Temperature	72	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	1.2	MBH	
Annual Standby Hot Water Load	10,549	MBTU/yr	
Total Annual Hot Water Demand	80,000	MBTU/yr	
Proposed Avg. Hot water heater efficiency	90%		Estimated
Proposed Fuel Use	889	Therms	Standby Losses and inefficient DHW heater eliminated
Utility Cost	\$1.61	\$/Therm	
Existing Operating Cost of DHW	\$1,610	\$/yr	
Proposed Operating Cost of DHW	\$1,431	\$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Therms/yr	111	\$179

City of East Orange
CHA Project Number: 30993
Garage DPW

Multipliers	
Material:	1.03
Labor:	1.25
Equipment:	1.12

ECM-5 Replace the DHW Heaters with Condensing Heaters - Cost

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Condensing Heater	1	EA	\$ 2,500	\$ 500		\$ 2,568	\$ 623	\$ -	\$ 3,191	From Internet Price/ Estimated Cost*
Miscellaneous Electrical/Controls	1	LS				\$ -	\$ -	\$ -	\$ 1,000	Estimated

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

\$ 4,191	Subtotal
\$ 1,467	35% Contingency
\$ 5,657	Total

City of East Orange
 CHA Project Number: 30993
 Garage DPW

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
Garage DPW

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	5	
Average Flushes / Toilet (per Day)	3	
Average Gallons / Flush	3.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	5	
Proposed Gallons / Flush	1.28	Gal

SAVINGS		
Current Toilet Water Use	19.16	kGal / year
Proposed Toilet Water Use	7.01	kGal / year
Water Savings	12.15	kGal / year
Cost Savings	\$61	/ year

City of East Orange
CHA Project Number: 30993
Garage DPW

ECM: Replace faucets and shower 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	6	
Average Uses / Faucet (per day)	1	# Uses
Average Time of Use	500.0	seconds
Average Flowrate	2.0	gpm

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	6	
Proposed Flowrate	0.5	gpm

HEATING SAVINGS		
Fuel Cost	\$ 1.61	/kWh
Number of Faucets	6	
Hours per Day of Usage	0.1	hrs
Days per Year of Facility Usage	365	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	36.50	kGal / year
Proposed Faucet Water Use	9.13	kGal / year
Water Savings	27.38	kGal / year
Heating Savings	100	Therms
Cost Savings	\$297	/ 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
Garage DPW

#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	5	EA	\$ 1,400	\$ 1,000	\$ -	\$ 7,189	\$ 6,230	\$ -	\$ 13,419	Vendor Estimate
Low-Flow Faucet	6	EA	\$ 700	\$ 300	\$ -	\$ 4,313	\$ 2,243	\$ -	\$ 6,556	Vendor Estimate
						\$ -	\$ -	\$ -	\$ -	

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

\$ 27,410	Subtotal
\$ 9,594	35% Contingency
\$ 37,004	Total

City of East Orange
CHA Project Number: 30993
Garage DPW

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 include 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)

Incentive #1	
Audit is funded by NJ BPU	\$0.05 \$/sqft
Total Building Area (Square Feet)	71,874
Is this audit funded by NJ BPU (Y/N)	Yes

Board of Public Utilities (BPU)

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	\$69,907	\$45,860
Existing Usage (from utility)	293,280	39,611
Proposed Savings	67,301	5,422
Existing Total MMBtus	5,159	
Proposed Savings MMBtus	799	
% Energy Reduction	15.5%	
Proposed Annual Savings	\$24,599	

	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	\$0.09	\$0.92
Incentive #3	\$0.09	\$0.90	\$0.005	\$0.05	\$0.11	\$1.25	\$0.09	\$0.92

	Incentives \$		
	Elec	Gas	Total
Incentive #1	\$0	\$0	\$5,000
Incentive #2	\$6,219	\$5,010	\$11,229
Incentive #3	\$6,219	\$5,010	\$11,229
Total All Incentives	\$12,439	\$10,020	\$27,459

Total Project Cost	\$224,287
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		Allowable Incentive
% Incentives #1 of Utility Cost*	4.3%	\$5,000
% Incentives #2 of Project Cost**	5.0%	\$11,229
% Incentives #3 of Project Cost**	5.0%	\$11,229
Total Eligible Incentives***		\$27,459
Project Cost w/ Incentives		\$196,828

Project Payback (years)	
w/o Incentives	w/ Incentives
9.1	8.0

* 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



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.

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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

265,932 kWh per Year *

System output may range from 255,800 to 278,563kWh per year near this location.

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)	Energy Value (\$)
January	2.36	13,892	1,025
February	3.14	16,635	1,228
March	4.05	23,273	1,718
April	4.82	25,935	1,914
May	5.69	30,697	2,265
June	5.94	30,227	2,231
July	5.75	29,892	2,206
August	5.37	27,705	2,045
September	4.63	23,760	1,753
October	3.59	19,582	1,445
November	2.34	12,834	947
December	1.99	11,499	849
Annual	4.14	265,931	\$ 19,626

Location and Station Identification

Requested Location	333 Glenwood Avenue East Orange, NJ 07017
Weather Data Source	(TMY2) NEWARK, NJ 4.5 mi
Latitude	40.7° N
Longitude	74.17° W

PV System Specifications (Commercial)

DC System Size	220.3 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	10°
Array Azimuth	160°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.07 \$/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.

Photovoltaic (PV) Solar Power Generation - Screening Assessment

City of East Orange Central Garage

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	Annual Utility Savings				Estimated	Total	Federal Tax	New Jersey	Payback	Payback
Cost					Maintenance	Savings	Credit	Renewable	(without	(with
					Savings			** SREC	incentive)	incentive)
\$	kW	kWh	therms	\$	\$	\$	\$	\$	Years	Years
\$881,200	220.3	265,932	0	\$34,837	0	\$34,837	\$0	\$66,483	25.3	8.7

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

Area Output*

1,469 m²
15,812 ft²

Perimeter Output*

0 m
0 ft

Available Roof Space for PV:

(Area Output - 10 ft x Perimeter) x 85%
13,440 ft²

Approximate System Size:

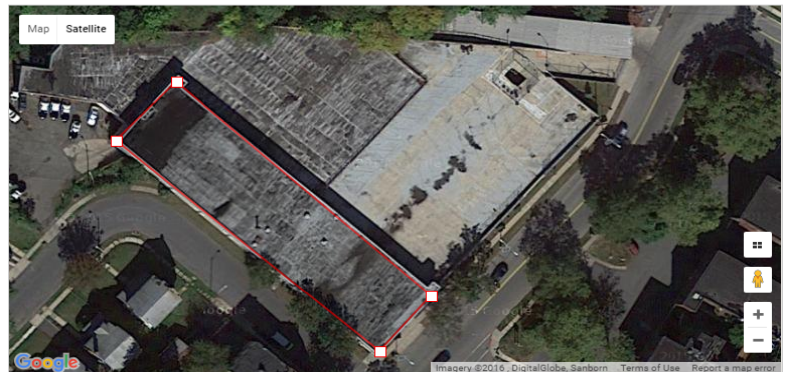
Is the roof flat? (Yes/No) Yes

8 watt/ft²
426,497 DC watts
220 kW From PV Watts

PV Watts Inputs***

Enter into PV Watts (always 20 if flat, if
Array Tilt Angle 10 pitched - enter estimated roof angle)
Array Azimuth 160 Enter into PV Watts (default)
Zip Code 07019 Enter into PV Watts
DC/AC Derate Factor 0.83 Enter into PV Watts

System Capacity: 220.3 kWdc (1469 m²)



PV Watts Output

265,932 annual kWh calculated in PV Watts program

% Offset Calc

Usage 339,360 (from utilities)
PV Generation 265,932 (generated using PV Watts)
% offset 78%

* <http://www.freemaptools.com/area-calculator.htm>

** <http://www.fletexchange.com>

*** http://gisatnrel.nrel.gov/PVWatts_View/index.html

APPENDIX E

Photos



Existing Windows and Window AC Units



Existing Boilers



Existing DHW Heater

APPENDIX F

EPA Benchmarking Report



ENERGY STAR[®] Statement of Energy Performance

N/A

Public Works and Central City Garage

Primary Property Type: Repair Services (Vehicle, Shoe, Locksmith, etc.)
Gross Floor Area (ft²): 71,874
Built: 1960

ENERGY STAR[®]
Score¹

For Year Ending: October 31, 2014
Date Generated: April 20, 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

Public Works and Central City Garage
333 Glenwood Ave
East Orange, New Jersey 07017

Property Owner

,
(____)____-____

Primary Contact

,
(____)____-____

Property ID: 4937136

Energy Consumption and Energy Use Intensity (EUI)

Site EUI

69 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	1,000,671 (20%)
Natural Gas (kBtu)	3,961,091 (80%)

National Median Comparison

National Median Site EUI (kBtu/ft ²)	68.2
National Median Source EUI (kBtu/ft ²)	100.4
% Diff from National Median Source EUI	1%

Source EUI

101.6 kBtu/ft²

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO ₂ e/year)	344
---	-----

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)