ROXBURY TOWNSHIP
TOWN HALL / POLICE DEPARTMENT
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for the Roxbury Township Town Hall/Police Department (building). The single story, approximately 29,520 square foot building houses the township's Manager's Office, Clerk's Office, Construction Department, Engineering Department, Finance, Municipal Court, Planning & Zoning, Public Works, Tax Assessor, Tax Collector, and Police Department offices.

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

This report shall cover the energy audit for the Roxbury Town Hall and Police Department.

2.0 EXECUTIVE SUMMARY

This report details the results of the Roxbury Township Town Hall/Police Department, located in Roxbury, New Jersey, which houses municipal offices and the Police Department. The following areas were evaluated for energy conservation measures:

- Lighting replacement with occupancy sensors
- Energy management control system upgrade
- Door/window seal upgrades
- Condensing boiler
- Restroom fixture upgrades
- Domestic hot water heater

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Measures which are recommended for implementation have a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of $22,100 for the recommended ECMs may be realized with a payback of 2.6 years.

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

ECM-1c Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,500	0.4	19,840	0	2,900	8.79	600	1.6	1.3

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

ECM-2 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,300	0	60	110	200	0.31	200	6.5	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-3b Replace Window Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,800	0.2	510	840	1,300	0.53	1,600	6.8	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-4e Energy Management Control System

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$32,900	0.0	27,200	3,510	$9,600	3.39	11,200	3.4	2.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-5 Condensing Boiler Installation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
16,900	0	31,960	(1,190)	3,400	3.00	3,600	5.0	3.9

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-7b Replace Toilets and Flush Valves with Low Flow Types

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
8,200	125	1,000	1.45	NA	8.2	NA

* No incentive available.

ECM-7c Install Low Flow Faucets

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
2,400	410	3,300	19.37	NA	0.7	NA

* No incentive available.

ECM-7d Install Low Flow Showerheads

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
100	50	400	57.51	NA	0.3	NA

3.0 EXISTING CONDITIONS

3.1 Building General

3.1.1 Structure

The building, constructed in 1974, is a 29,520 square foot facility consisting of various municipal offices and Police Department. The township relocated to this building in 1996 and major renovations were performed, including complete remodeling of the interior.

The exterior is composed of face brick and concrete with some glass walls built on a concrete foundation. The walls separating the Police Department from the Town Hall offices are constructed of concrete masonry unit (CMU), with metal studs and gypsum board on the remainder of the interior.

The windows and doors are single pane glass with metal frames. The building has two main entrances, one serving the municipal offices, the other the police department. There are several emergency exit doors around the perimeter, as well as a police patrol and a sallyport entrance for prisoner transportation.

The roof system is a flat gray membrane roof, and was recoated in 2008. The roof is scheduled to be replaced in the near future due to age; roof drains are original to the building's construction.

3.1.2 Operating Hours

The building offices are open from 8:00 AM – 5:00 PM weekdays, with the custodian arriving at 6:00 AM. The Police Department operates 24 hours a day, seven days a week. The municipal court is operational on Thursday evenings until approximately 10:00 PM.

3.2 Utility Usage

The building uses electricity, natural gas, municipal water, and is connected into the municipal sewage system.

Electricity is purchased and delivered by Jersey Central Power & Light (JCP&L), and natural gas purchased and delivered by New Jersey Natural Gas (NJNG). For 2008, the building had an annual electricity consumption of 581,360 kWh at a cost of $93,700, natural gas usage of 10,100 therms at a cost of $15,100, and water usage of 175,000 gallons at an estimated cost of $1,400. The total utility bill for 2008 was $108,800, not including water usage. The Township of Roxbury provided water usage; however, water cost was not included. Therefore, for water calculations, it was estimated at $8.00 per thousand gallons.

The largest portion of energy usage is for electricity and the average blended rate was $0.16 per kWh. The electricity usage trend shows higher consumption during the summer cooling months.

The majority of natural gas is used for building heating as indicative of the higher usage trend during the colder months of November through April. The average blended rate for natural gas was $1.50 per therm.

Utility data is provided in Appendix A.

3.3 HVAC Systems

3.3.1 Central Systems

At one time, the building was heated by hot water produced by a natural gas fired boiler and circulated through a piping system to perimeter fintube radiation. This boiler was removed approximately nine years ago; the piping system remains abandoned in place. The boiler room space is used for storage.

The current HVAC system is comprised of five direct expansion cooling/natural gas heating rooftop units, which are between 3½ and 14 years' old (see Appendix B for an Equipment Inventory). The oldest unit, a Carrier rooftop unit (Model No. 48TJE028, Series 600QA) that serves the Police Chief's office and surrounding areas has been repaired numerous times in the past year and if issues persist, this unit will eventually need to be replaced. In addition, the office occupants noted that the Lennox rooftop unit (Model LGA240SS1G) that serves the Council Room is typically shut off before meetings due to excessive noise issues. The remaining units have not experienced significant operational issues. Two DX split systems provide air conditioning to the Computer Room and Police Dispatch Room. Numerous perimeter offices contained small portable electric space heaters because the perimeter of the building is not adequately heated by the rooftop units. However, no space heaters were observed in other portions of the building; therefore, it was assumed that adequate heat was provided by the rooftop units during the winter months.

3.3.2 Hot Water Heating Systems

Hot water is produced by one A.O. Smith electric hot water tank located in a small utility room adjacent to the old boiler room. The tank has a capacity of 80 gallons and utilizes 18 kW of electricity when both elements are energized.

3.3.3 Controls

The building does not have a direct digital control (DDC) system to monitor the building's heating, air conditioning, and ventilating systems. A DDC system would provide the building with a central user interface used to schedule the HVAC equipment to turn off or provide temperature setback during unoccupied hours.

Wall mounted thermostats control the space temperature provided by five HVAC rooftop units and variable air volume (VAV) boxes supply air to the spaces.

3.4 Lighting/Electrical Systems

The interior lighting within the building is comprised of mainly T-8 fluorescent light fixtures with some less efficient T-12 fluorescent fixtures. The T-12s are original to building construction and located mainly in mechanical areas, restrooms, and inmate cells. The T-8s are used most frequently within the building and are a mixture of 4' and 8' as well as 2' u-tube fixtures. Lighting is controlled by individual switches in each space or ceiling mounted occupancy sensors. It was noted that some occupancy sensors were not operating properly. Many lights within the building were wired directly to breakers and assumed to remain in use continuously.

In the common areas within the police department sector of the building, the lights are mandated to remain on 24 hours a day for safety reasons. In office areas within the police department and town hall, the lighting remains on depending on occupancy, generally about 10 hours a day.

The exit signs are all energy efficient LED type wired individually to breakers.

The building's parking lot lighting consists of a mixture of metal halide and high pressure sodium fixtures that utilize bulbs ranging from 70 to 400 watts. The exterior lighting is controlled by a timer.

3.5 Plumbing Systems

The plumbing system consists of domestic water, sanitary, and vent piping. The systems are typical for a municipal building. Domestic hot water is generated by one electric hot water heater with a storage capacity of 80 gallons. Plumbing fixtures include urinals, lavatories, sinks, showers, and floor drains.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1a Lighting Replacements

A comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, and the number of fixtures, locations, and existing wattage established. Most of the lighting consists of T-8 fluorescent fixtures with electronic ballasts, which are regarded as efficient by today's standards. A small portion of the facility's lighting consists of T-12 fixtures with magnetic ballasts. Exit signs utilize high efficiency LED technology and incandescent lighting has been replaced with efficient compact fluorescent fixtures.

Overall energy consumption can be reduced by retrofitting the approximately 13 T-12 fixtures with more efficient T-8 fluorescent lamps. Existing T-12 lamps and ballasts of each fixture can be replaced with electronic ballasts and two or three 4', T-8 fluorescent lamps as required.

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

The fluorescent lighting retrofits have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 29,400 kWh and $4,700.

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

ECM-1a Lighting Replacements

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,500	0.4	1,960	0	300	2.04	100	5.0	4.7

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

This measure is not recommended as a stand alone ECM in lieu of ECM-1c.

4.2 ECM-1b Install Occupancy Sensors

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

Lighting fixtures are manually switched on and off or automatically controlled with the use of existing occupancy sensors. Some occupancy sensors within the building were noted to be nonoperational and should be replaced. The lights are operational from opening to closing of the building based on

occupancy. Each interior building light is operated approximately 70 hours per week. The lighting within many spaces of the Police Department remains in use continuously, and occupancy sensors were not considered for the general areas due to safety concerns.

Typical traffic patterns for each space were then taken into account to approximate the actual occupancy hours per day. Approximately 22 occupancy sensors and some standard electrical work are required for this measure.

Lighting controls have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 273,900 kWh, and $39,800.

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

ECM-1b Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,500	0.0	18,260	0	2,700	10.46	600	1.3	1.1

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

This measure is not recommended as a stand alone ECM in lieu of ECM-1c.

4.3 ECM-1c Lighting Replacements with Occupancy Sensors

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

The lighting retrofits and controls have an expected lifetime of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 297,620 kWh, and $43,700.

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

ECM-1c Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,500	0.4	19,840	0	2,900	8.79	600	1.6	1.3

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

This measure is recommended.

4.4 ECM-2 Door Seals

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

Door seals have an expected life of 10 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 600 kWh, 1,050 therms and $2,000.

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

ECM-2 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,300	0	60	110	200	0.31	200	6.5	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is recommended.

4.5 ECM-3a Window Replacements

The windows, single pane glass and original to building construction, incur infiltration, cold drafts, and heat loss. This ECM evaluates replacement with new energy efficient windows.

This measure was calculated by determining the square footage and perimeter length of the single pane windows. The building has over 1,800 square feet of window area. Weather bin data determined heating and cooling hours and associated energy savings. As with most window replacements, the energy saved alone does not justify the project. Window replacement is not recommended due to the long payback, additional considerations may be improved comfort and appearance.

The windows have an expected life of 20 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 11,000 kWh, 45,120 therms and $69,300.

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

ECM-3a Window Replacements

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
65,700	0.2	550	2,260	3,500	0.06	4,200	18.8	17.6

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is not recommended.

4.6 ECM-3b Replace Window Seals

In lieu of window replacement, the ECM evaluated installation of seals around the perimeter of windows at the location where the glass connects to the window frame. The windows are original to the building construction and the glass/frame seal has worn due to age. Installing window seals will reduce infiltration, eliminate cold drafts, improve employee comfort, and save energy.

This measure was calculated by determining the perimeter length of the windows. The building windows have over 1,700 linear feet of window frame. Weather bin data determined heating and cooling hours and associated energy savings. Cost to install window seals for each window is approximately $100 per window, if a contractor was used for this effort.

High grade window seals have an expected life of 10 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 5,100 kWh, 8,400 therms, and $13,400.

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

ECM-3b Replace Window Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,800	0.2	510	840	1,300	0.53	1,600	6.8	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is recommended.

4.7 ECM-4a Night Setback Controls

The building's HVAC systems have programmable thermostats for controlling space temperature; however, temperature setback is not utilized. This measure proposes that a DDC system be installed in conjunction with new thermostats to be programmed for night setback of the heating and cooling space temperatures. Temperatures could, therefore, be controlled and programmed from a central computer. As part of this measure, all air cooled condensers should be cleaned to reduce the operating head pressure of the compressors, improving system efficiency.

It should be noted that the Township of Roxbury could achieve similar energy savings without installation of a centralized DDC if the existing thermostats were programmed for a night setback of 80°F for unoccupied summer cooling, and 60°F for unoccupied winter heating. The thermostats would need to be secured such that occupants could not change the programmed night setback.

Night setback has an expected lifetime of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 79,650 kWh, 31,950 therms and $59,200.

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

ECM-4a Night Setback Controls

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$23,600	0.0	5,310	2,130	$4,000	1.57	4,800	5.9	4.7

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is not recommended as a stand alone ECM in lieu of ECM-4e.

4.8 ECM-4b Night Shutdown

The building's HVAC systems have programmable thermostats for controlling space temperature yet presently they do not setback or shut down building systems when not occupied. This measure proposes that the DDC control system be installed in conjunction with new thermostats to be programmed for night shutdown. This measure calculates energy savings based on shutting down electric components such as exhaust fans and compressors.

Night shutdown has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 188,900 kWh and $30,400.

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

ECM-4b Night Shutdown

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$14,800	0.0	12,590	0	$2,000	1.06	2,300	7.4	6.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

It should be noted that the Township of Roxbury could achieve similar energy savings without the installation of a centralized DDC. Local controls or timeclocks could achieve the same effect at lower cost.

This measure is not recommended as a stand alone ECM in lieu of ECM-4e.

4.9 ECM-4c Enthalpy Economizer

Heat internal to the building such as people, lights, computers, copy machines, motors and other machines causes the temperature inside to increase. This energy conservation measure considers turning off the packaged rooftop units' compressors and using cool outside air to satisfy the cooling needs of the building when outside temperature makes this option feasible. An economizer with enthalpy control that measures the outdoor temperature and humidity is proposed for this measure. The enthalpy control would measure both sensible and latent heat in the air and allow outside air to be used for cooling if sufficiently cool and dry to satisfy the space conditions. This condition has been calculated to occur approximately from 47 to 60° outdoor air temperature. If the indoor thermostat calls for cooling and the outside air enthalpy is sufficiently low, the economizer would bring in the cooler and less humid air and use it for

cooling instead of operating the compressor. Using the outside air for cooling is less expensive than operating the compressor to provide cooling.

It should be noted that the Township of Roxbury could achieve similar energy savings without installation of a centralized DDC. Local controls could achieve the same effect at a lower cost.

Enthalpy economizers have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 108,600 kWh and $17,500.

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

ECM-4c Enthalpy Economizer

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$30,500	0.0	7,240	0	$1,200	-0.43	1,300	>25	24.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is not recommended as a stand alone in lieu of ECM-4e.

4.10 ECM-4d Install Demand Control Ventilation

An energy savings option would be to utilize demand control ventilation (DCV), which measures carbon dioxide (CO_2) in the return air stream to an air handler and adjusts the outside air ventilation to maintain a CO_2 specified setpoint. An increase in CO_2 is representative of an increase in the number of occupants in a space. Outside air dampers would modulate and allow only the required amount of outside ventilation needed to match room occupancy. By controlling the ventilation based on occupancy, savings of natural gas and electricity can be achieved.

To determine savings, the energy needed for full constant outside air ventilation requirements was compared to the energy needed for variable ventilation based on room occupancy. The outside air CFM rates are based on equipment information and code requirements for outside air ventilation. Hourly weather bin data for heating and cooling periods along with current room temperature setpoints were used to determine savings.

Installing DCV would require CO_2 sensors, upgrades to the outside air damper actuators, control system programming, and electrical wiring modifications.

Demand control ventilation has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 30,660 kWh and $35,900.

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

ECM-4d Install Demand Control Ventilation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$20,200	0.0	2,040	1,380	$2,400	0.77	2,800	8.4	7.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is not recommended as a stand alone ECM in lieu of ECM-4e.

4.11 ECM-4e Energy Management Control System

This measure proposes to install a DDC system, which would control space temperature from a single location. This measure combines ECM-4a, b, c, and d into an integrated control system. Implementing these measures would result in annual savings since less energy will be required to heat and cool the outside air. Utilizing a DDC system will also provide occupant comfort.

The DDC system has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 408,000 kWh, 52,600 therms and $144,300.

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

ECM-4e Energy Management Control System

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$32,900	0.0	27,200	3,510	$9,600	3.39	11,200	3.4	2.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is recommended.

4.12 ECM-5 Condensing Boiler Installation

The building previously utilized a hot water boiler to heat the building. The boiler has since been removed; however, the piping system remains. Perimeter heating is currently performed by small portable space heaters used by individuals in most of the outer offices. These heaters frequently cause tripping of circuit breakers when the load exceeds rated capacity.

There are currently more efficient units such as condensing boilers that can provide efficiencies of 93%. The energy saved is determined by comparing the difference in the energy used by the existing electric space heaters and proposed condensing boiler for hot water heating.

Condensing boilers work on the principle of recovering as much waste heat as possible, which is normally ejected into the atmosphere from the flue of a conventional (non-condensing) boiler. This design maximizes the heat transfer from the burner and recovers useful heat which would normally be lost with the flue gases. When in condensing mode, (condensing boilers do not condense continually) the flue gases

give up latent heat which is then recovered by the heat exchanger within the boiler. As a result, the temperature of the gases exiting the flue of a condensing boiler is typically 120-140°F.

The old boiler room was converted to a high-end storage system, which may remove the area from consideration for installing the new high efficiency condensing boiler. A new boiler could be located in the adjacent utility area if minor modifications were made to remove unnecessary wall dividers around the domestic hot water storage room. The town would need to further evaluate how the building's utility space could be renovated. Modifications to the existing piping, electrical wiring, and flue stacks would also be required.

The high efficiency boilers would provide energy savings of 31,960 kWh off set by (1,190) therms for additional gas usage from new boiler.

The condensing boiler has an expected life of 20 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 639,200 kWh, additional gas usage equivalent to (23,720) therms, for a net total savings of $67,500.

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

ECM-5 Condensing Boiler Installation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
16,900	0	31,960	(1,190)	3,400	3.00	3,600	5.0	3.9

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is recommended.

4.13 ECM-6 Replace Domestic Hot Water Heater

Presently, domestic hot water is produced utilizing an electric hot water heater and storage tank. This unit has (2) 9 kilowatt heating elements immersed in an 80 gallon storage tank. This unit is installed in an area adjacent to the old boiler room. This measure proposes to install a condensing natural gas fired domestic hot water boiler, which will save energy. Gas as well as flue gas modifications would be needed for this upgrade.

Condensing natural gas fired domestic hot water boiler has an expected life of 20 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 69,500 kWh, additional gas usage equivalent to (1,000) therms for a net total savings of $9,700.

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

ECM-6 Replace Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
6,500	0	3,480	(50)	500	0.49	500	13.0	12.0

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

This measure is not recommended.

4.14 ECM-7 Water Conservation

4.14.1 ECM-7a Replace Urinal Flush Valves with Low Flow Types

The four urinals in the building are currently utilizing inefficient flush valves, which would be replaced with low flow models. By installing low flow valves, water usage can be reduced.

Twelve flushes per day per urinal are assumed for the calculation. The existing flush valves are rated for 1.5 gallons per flush for an estimated annual water usage of 26,000 gallons per year. The proposed valves are rated for 1.0 gallons per flush, which would result in an annual water savings of about 9,000 gallons per year.

Low flow urinal flush valves have an expected lifetime of about 20 years, and total estimated water and sewer savings over the life of the project are 180 kgal and $1,400.

This measure would result in savings of less than $100 and a long payback; therefore, it is not recommended.

4.14.2 ECM-7b Replace Toilet Flush Valves with Low Flow Types

There are 18 toilets in the building with non-efficient flush valves, which would be replaced with low flow flush valves. By installing low flow valves, water usage would be reduced.

For the calculations, ten flushes per day per toilet were assumed. The existing valves are rated for 3.5 gallons per flush; therefore, have an estimated annual water usage of 230,000 gallons per year. The proposed valves are rated for 1.6 gallons per flush; therefore, this measure would result in annual water savings of 125,000 gallons.

Low flow toilet flush valves have an expected lifetime of about 20 years, and total estimated water and sewer savings over the life of the project are 2,500 kgal and $20,000.

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

ECM-7b Replace Toilets and Flush Valves with Low Flow Types

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	Kgal	$		$	Years	Years
8,200	125	1,000	1.45	NA	8.2	NA

* No incentive available.

This measure is recommended.

4.14.3 ECM-7c Install Low Flow Faucets

Sink faucets typically use approximately three gallons per minute for normal use. Low flow faucets will discharge less water in the restroom sinks; this measure would install new low flow faucets on the 15 restroom sinks in the building

The proposed low flow faucets are rated for 1.5 gallons per minute; therefore, this measure would result in an annual water savings of about 411,000 gallons per year. At a combined water and sewer charge of $8.00 per thousand gallons, this results in a cost savings of about $3,300 per year.

Low flow faucets have an expected lifetime of about 15 years, and total estimated annual water and sewer savings over the life of the project are 6,150 kgal and $49,300.

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

ECM-7c Install Low Flow Faucets

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
2,400	410	3,300	19.37	NA	0.7	NA

* No incentive available.

This measure is recommended.

4.14.4 ECM-7d Install Low Flow Showerheads

There are three showers in the building, with standard showerheads nominally rated at 2.5 GPM. LEED information indicates that an average shower lasts approximately five minutes. This measure would install new 1.6 GPM showerheads to replace the existing 2.5 GPM showerheads.

This measure would result in an annual water savings of about 49,000 gallons per year. At a combined water and sewer charge of $8.00 per thousand gallons, this results in a cost savings of about $400 per year.

Low flow showerheads have an expected lifetime of about 15 years, and total estimated annual water and sewer savings over the life of the project are 735 kgal and $5,900.

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

ECM-7d Install Low Flow Showerheads

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	Kgal	$		$	Years	Years
100	50	400	57.51	NA	0.3	NA

* No incentive available.

This measure is recommended.

4.15 Potential Incentives

The Roxbury Town Hall and Police Department energy conservation project may be eligible for incentives by the New Jersey Office of Clean Energy. The largest incentives available will be for the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities that consume a minimum average electric demand of 200 kW per month (total of 12 months peak demand/12). Facilities that meet this criterion must also achieve a minimum performance target of 15% by using an approved simulation modeling tool before and after construction. Implementing the measures recommended in this report will allow the building to achieve this reduction (see Appendix Q). To utilize this program, a P4P Partner would need to be engaged.

Incentives for this program include the following:

- Incentive #1: The P4P Program pays $0.05 per square foot to a maximum of $50,000 or 50% of facility annual energy cost for the P4P Partner to develop an Energy Reduction Plan (ERP). This incentive is paid after approval of the ERP and signed Installation Agreement. Applicant must agree to commit to implementation of the ERP within 6 months or the incentive must be returned to the state. For the 29,520 square foot building this corresponds to approximately $1,500.

- Incentive #2: Paid after installation of recommended measures; base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

- Incentive #3: Paid after acceptance of Post-Construction Benchmarking Report showing energy savings over one year utilizing the approved simulation modeling tool and EPA Portfolio Manager. Incentive #3 base incentives deliver $0.07/kWh and $0.70/therm not to exceed 20% of total project cost.

Combining Incentives #2 and #3 will deliver a total of $0.18/ kWh and $1.80/therm not to exceed 50% of total project cost. Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the minimum performance target calculated with the approved simulation modeling tool, not to exceed 50% of total project cost.

A new incentive structure has been announced for projects exceeding 20% in energy savings utilizing the required EPA portfolio manager benchmarking tool. The new incentive structure will double incentives #2 and #3 therefore producing a total of $0.36/kWh and a $3.60/ therm for those projects exceeding 20%. Incentive #1 for application preparation and energy reduction plan development has not changed however

the maximum incentive has now been raised to 80% of project costs. The 200 kW/month average minimum has been dropped so any structure can apply. This new incentive structure will be in effect until December 31, 2009.

Incentives are also available for prescriptive measures for various types of equipment under the New Jersey SmartStart Buildings incentive program. Prescriptive measures are paid after installation and no energy savings verification will be required. There are incentives available under this program for the lighting control occupancy sensors (ECM-1c), and the gas heating boiler replacement (ECM-5), suggested in this study. The lighting fixtures and controls energy reduction incentives were calculated utilizing the New Jersey SmartStart Building Equipment incentive program. This program provides incentives dependent upon the existing equipment type and proposed equipment retrofit measure. If Roxbury qualifies and enters into the New Jersey Pay for Performance Program, gas heating and lighting control will be included in total building energy usage and savings. Applicants cannot apply for both programs for the same project.

5.0 ALTERNATIVE ENERGY SCREENING EVALUATION

5.1 Geothermal

Geothermal heat pumps (GHP) transfer heat between the constant temperature of the earth and the building to maintain the building's interior space conditions. Below the surface of the earth throughout New Jersey the temperature remains in the low 50°F range throughout the year. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. With GHP systems, water is circulated between the building and the piping buried in the ground. The ground heat exchanger in a GHP system is made up of a closed or open loop pipe system. Most common is the closed loop in which high density polyethylene pipe is buried horizontally at 4-6 feet deep or vertically at 100 to 400 feet deep. These pipes are filled with an environmentally friendly antifreeze/water solution that acts as a heat exchanger. In the summer, the water picks up heat from the building and moves it to the ground. In the winter the system reverses and fluid picks up heat from the ground and moves it to the building. Heat pumps make collection and transfer of this heat to and from the building possible.

The building's boiler, which was removed, served the perimeter hot water fintube radiation. Heating and cooling is provided by five natural gas fired rooftop units and two ductless split DX units. To take advantage of a GHP system, the building would have to install a low temperature closed loop water source heat pump system to realize the benefit of the consistent temperature of the ground. This will also include removal of the existing heating and cooling system.

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

5.2 Solar

5.2.1 Photovoltaic Rooftop Solar Power Generation

The building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The building's roof has sufficient room to install a large solar cell array. A structural analysis would be required to determine if the roof framing could support a cell array.

The PVWATTS solar power generation model was utilized to calculate PV power generation. The New Jersey Clean Power Estimator provided by the New Jersey Clean Energy Program is presently being updated; therefore, the site recommended use of the PVWAT solar grid analyzer version 1. The closest city available in the model is Newark, New Jersey and a fixed tilt array type was utilized to calculate energy production. The PVWAT solar power generation model is provided in Appendix R.

The State of New Jersey incentives for non-residential PV applications is $1.00/watt up to 50 kW of installed PV array. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes; therefore, would not be able to utilize the federal tax credit incentive.

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to

1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is $689; this is the amount that must be paid per SERC by the high emission producers. The expected dollar amount that will be paid to the PV producer for 2009 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

The Roxbury Town Hall and Police Building had a maximum kW demand of 162 kW and a minimum kW of 88 kW over the 12 months considered in this study. The monthly average over the observed 12 month period was 125 kW. The facility's existing load should justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 50 kW system size was selected for the calculations. The system costs for PV installations were derived from the most recent NYSERDA (New York State Energy Research and Development Agency) estimates of total cost of system installation. It should be noted that the cost of installation is currently $10 per watt or $10,000 per kW of installed system. This has increased in the past few years due to the rise in national demand for PV power generator systems. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

ECM – S1 Photovoltaic (PV) Rooftop Solar Power Generation – 50 kW System

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive*	New Jersey Renewable SREC**	Payback (without incentive)	Payback (with incentives)
	Electricity		Natural Gas	Total					
$	kW	kWh	Therms	$	$	$	$	Years	Years
500,000	0	59,200	0	9,500	9,500	50,000	28,800	>25	11.7

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $1.00 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

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

5.2.2 Solar Thermal Domestic Hot Water Plant

Active solar thermal systems use solar collectors to gather the sun's energy to heat water, another fluid, or air. An absorber in the collector converts the sun's energy into heat. The heat is then transferred by circulating water, antifreeze, or sometimes air to another location for immediate use or storage for later utilization. Applications for active solar thermal energy include providing hot water, heating swimming pools, space heating, and preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted around the site's latitude, to maximize the amount of radiation collected on a yearly basis.

Several options exist for using active solar thermal systems for space heating. The most common method involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system). The most practical system for East Brunswick would transfer the heat from the panels to thermal storage tanks and transfer solar produced thermal energy to use for domestic hot water production.

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

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

ECM – S2 Solar Thermal Domestic Hot Water Plant

Budgetary	Annual Utility Savings				Total	New Jersey Renewable	Payback	Payback
Cost					Savings	Energy Incentive	(without incentive)	(with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$	$	$	Years	Years
5,700	0	3,300	0	500	500	NA	11.4	NA

* No incentive is available in New Jersey at this time.

This measure is not recommended.

5.3 Wind

Small wind turbines use a horizontal axis propeller, or rotor, to capture the kinetic energy of the wind and convert it into rotary motion to drive a generator which usually is designed specifically for the wind turbine. The rotor consists of two or three blades, usually made from wood or fiberglass. These materials give the turbine the needed strength and flexibility, and have the added advantage of not interfering with television signals. The structural backbone of the wind turbine is the mainframe, and includes the slip-rings that connect the wind turbine, which rotates as it points into changing wind directions, and the fixed tower wiring. The tail aligns the rotor into the wind.

To avoid turbulence and capture greater wind energy, turbines are mounted on towers. Turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller turbines can utilize shorter towers. For example, a 250-watt turbine may be mounted on a 30-50 foot tower, while a 10 kW turbine will usually need a tower of 80-120 feet. Tower designs include tubular or latticed, guyed or self-supporting. Wind turbine manufacturers also provide towers.

The New Jersey Clean Energy Program for small wind installations has designated numerous pre-approved wind turbines for installation in the State of New Jersey. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Systems sized under 16,000 kWh per year of production will receive a $3.20 per kWh incentive. Systems producing over 16,000 kWh will receive $51,200 for the first 16,000 kWh of production with an additional $0.50 per kWh up to a maximum cap of 750,000 kWh per year. Federal tax credits are also available for renewable energy projects up to 30% of installation cost for systems less than 100 kW. However, as noted previously, municipalities do not pay federal taxes and is, therefore, not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the Roxbury New Jersey area, the map indicates a mean annual

wind speed of below 10 miles per hour. For the building, there are site restrictions. Parking lots, radio communication towers, trees, and local residential housing would greatly affect a tower location.

An aerial satellite image of the municipal site and wind speed map is included in Appendix T.

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

5.4 Combined Heat and Power Generation (CHP)

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

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location.

The Municipal Building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter. Thermal usage during the summer months is low, and thermal energy produced by the CHP plant will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building.

The most viable option for a CHP plant would be a reciprocating engine natural gas-fired unit. However, since the building is located in a residential area, noise may be an issue.

This measure is not recommended due to limited use of summertime heat.

5.5 Biomass Power Generation

Biomass power generation is a process in which waste organic materials are used to produce electricity or thermal energy. These materials would otherwise be sent to the landfill or expelled to the atmosphere. To participate in NJCEP's Customer On-Site Renewable Energy program, participants must install an on-site sustainable biomass or fuel cell energy generation system. Incentives for bio-power installations are available to support up to 1MW-dc of rated capacity.

*Class I organic residues are eligible for funding through the NJCEP CORE program. Class I wastes include the following renewable supply of organic material:

- Wood wastes not adulterated with chemicals, glues or adhesives
- Agricultural residues (corn stover, rice hulls or nut shells, manures, poultry litter, horse manure, etc) and/or methane gases from landfills
- Food wastes
- Municipal tree trimming and grass clipping wastes
- Paper and cardboard wastes
- Non adulterated construction wood wastes, pallets

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

- Digestion of sewage sludge
- Landfill gas facilities
- Combustion of wood wastes to steam turbine
- Gasification of wood wastes to reciprocating engine
- Gasification or pyrolysis of bio-solid wastes to generation equipment

* from NJOCE Website

This measure is not recommended because the site does not have room to store the waste organic materials, noise issues, and potential zoning issues.

5.6 Demand Response Curtailment

Presently, the Roxbury Town Hall and Police Station Building has electricity delivered and supplied by Jersey Central Power and Lighting Corporation (JCP&L). Utility curtailment is an agreement with the regional transmission organization and an approved Curtailment Service Providers (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator, therefore reducing the electrical demand on the utility grid. PJM is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

This program is to benefit the utility company during high demand periods and PJM offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on their emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run their emergency generators with notice to test the system. A minimum of 100 kW of curtailable load is required to enter the program. Discussions with the EnerNoc Corporation, an approved CSP, indicate that existing emergency generators will not pass the emissions requirements to enter the program.

Presently, the building operates an 80 kW Kohler mode no. 80RZ82 natural-gas back up generator, and has an average kW demand during the observed period is 125 kW per month. The township is evaluating upgrading the current back-up generator to handle more loads.

This measure is not recommended because the facility does not have the ability to shed the required minimum load reduction.

6.0 EPA PORTFOLIO MANAGER

The United State Energy Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The program is designed to allow property owners and managers to share, compare and improve upon their facility's energy consumption. Inputting such parameters at electricity, heating fuel, building characteristics and location into the website based program generates a naturalized energy rating score out of 100. Once an account is registered, monthly utility data can be entered to track the savings progress and retrieve an updated energy rating score on a monthly basis.

Based on the dual-use of the building (Town Hall and Police Department), 72% of the building is designated as "Office" space and 28% is designated as "Other - Police Station" space. Since more than 50% of the building is Office, the building is designated as Office within Portfolio Manager, and would be eligible for an energy rating. However since more than 10% of the space is Other (i.e., Police Department), the building cannot receive a rating.

The building's performance, however, can be compared to national site and source EUI averages. With a Source Energy Intensity of 104.7 kBTU/ft^2/year, the building is considered a low-to-moderate energy consumer per the Portfolio Manager. Reducing energy loss associated with infiltration, equipment, and occupancy run hours will result in a more favorable score. If all the measures recommended in this report are fully implemented, it is projected that a Source Energy Usage Index of 83.8 kBTU/ft^2/year can be obtained.

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

7.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Township of Roxbury Town Hall and Police Station Building identified potential ECMs for door seals, energy management control systems, condensing boiler, and lighting fixture and occupancy sensor replacements. Potential annual savings of $22,100 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1c Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,500	0.4	19,840	0	2,900	8.79	600	1.6	1.3

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

ECM-2 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,300	0	60	110	200	0.31	200	6.5	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-3b Replace Window Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,800	0.2	510	840	1,300	0.53	1,600	6.8	5.5

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-4e Energy Management Control System

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
$32,900	0.0	27,200	3,510	$9,600	3.39	11,200	3.4	2.3

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-5 Condensing Boiler Installation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
16,900	0	31,960	(1,190)	3,400	3.00	3,600	5.0	3.9

* Incentive based on New Jersey Office of Clean Energy Pay for Performance Program.

ECM-7b Replace Toilets and Flush Valves with Low Flow Types

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
8,200	125	1,000	1.45	NA	8.2	NA

* No incentive available.

ECM-7c Install Low Flow Faucets

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
2,400	410	3,300	19.37	NA	0.7	NA

* No incentive available.

ECM-7d Install Low Flow Showerheads

Budgetary Cost	Annual Utility Savings		ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water / Sewer	Total				
$	kgal	$		$	Years	Years
100	50	400	57.51	NA	0.3	NA

APPENDIX A

Utility Usage Analysis

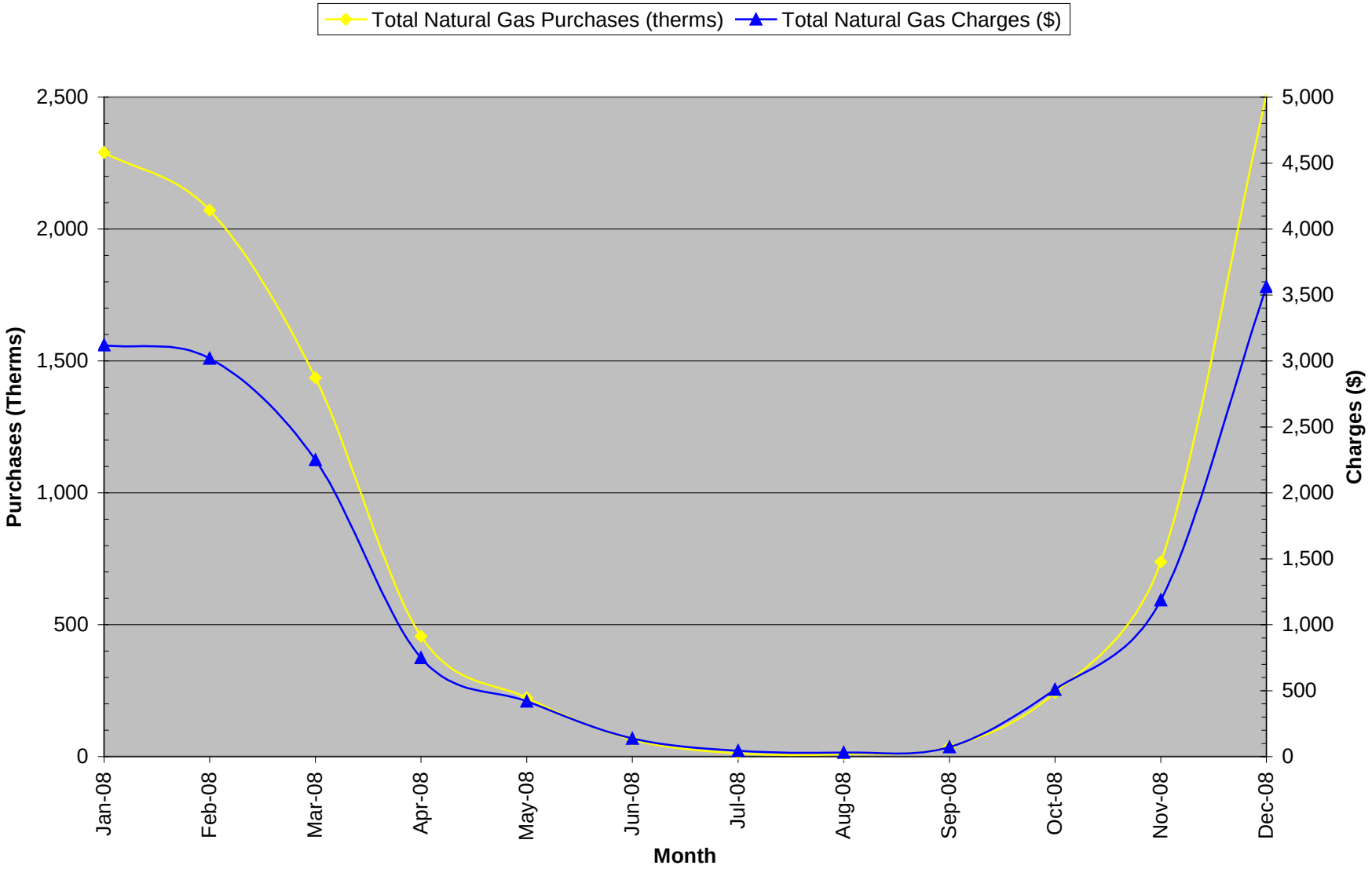
New Jersey BPU Energy Audit Program
CHA Project No. 20556
Building: Roxbury Township Town Hall/Police Department

Account Number: 01-1101-0641-39
New Jersey Natural Gas

Natural Gas Usage

Month	Charges ($)	Total Usage (Therms)	Rate ($/therm)
January-08	3,121	2,290	1.36
February-08	3,019	2,072	1.46
March-08	2,250	1,436	1.57
April-08	749	456	1.64
May-08	418	223	1.88
June-08	136	65	2.10
July-08	44	13	3.41
August-08	31	10	3.23
September-08	72	37	1.92
October-08	508	243	2.09
November-08	1,187	738	1.61
December-08	3,562	2,509	1.42
Total	$ 15,097	10,092	$1.50

Natural Gas Usage - Township of Roxbury Town Hall/Police Department



Utility Data - RoxburyMunicipal(rev-3).xls
Natural Gas Chart

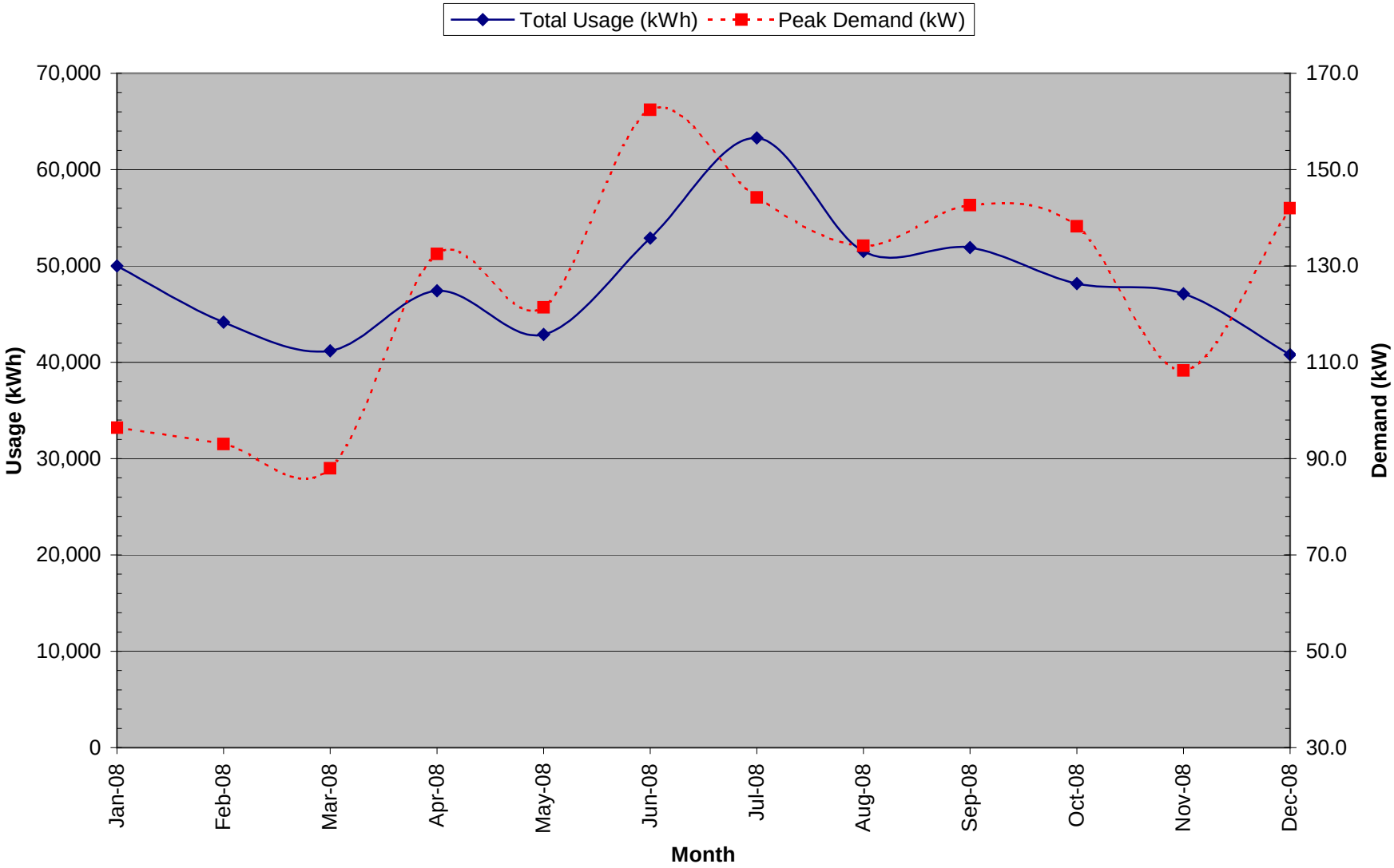
New Jersey BPU Energy Audit Program
CHA Project No. 20556
Building: Roxbury Township Town Hall/Police Department

Account Number: 10 00 00 2584 4 0
Jersey Central Power and Lighting

	Electricity						
Month	Supply kWH	Delivery KW	Cost ($)	Blended Rate ($/kWH)	Unit Cost ($/kWH)	Unit Cost ($/kW)	
January-08	50,000	96.4	7,385.11	0.1477	0.1365	5.80	
February-08	44,160	93.0	6,576.44	0.1489	0.1368	5.77	
March-08	41,200	88.0	5,856.73	0.1422	0.1299	5.73	
April-08	47,440	132.5	6,910.47	0.1457	0.1290	5.98	
May-08	42,880	121.4	7,178.20	0.1674	0.1494	6.37	
June-08	52,880	162.4	9,615.78	0.1818	0.1618	6.51	
July-08	63,280	144.2	11,205.42	0.1771	0.1624	6.46	
August-08	51,520	134.2	9,252.90	0.1796	0.1629	6.42	
September-08	51,920	142.6	8,072.93	0.1555	0.1390	6.02	
October-08	48,160	138.2	7,525.56	0.1563	0.1390	6.00	
November-08	47,120	108.3	7,229.29	0.1534	0.1399	5.87	
December-08	40,800	142.0	6,871.26	0.1684	0.1475	6.01	
Total	581,360	162.4	$ 93,680	0.1611	0.1453	6.08	

	Electricity											
Customer Charge	Energy Charge	Transmission Charge	Reconciliation Charge	Delivery Charge kWH	Delivery Charge kW	Non-Utility Gen. Chg	Societal Benefit	Transitional Assessment Charge	System Control Charge	Outdoor Lighting		Total
$11.65	$4,723.70	$259.26	$176.45	$300.31	$559.01	$848.00	$285.35	$146.40	$3.95	$71.03		$7,385.11
$11.65	$4,171.97	$223.84	$155.84	$271.36	$537.01	$748.95	$252.02	$129.30	$3.49	$71.01		$6,576.44
$11.65	$3,892.33	$208.93	-$145.03	$256.68	$504.66	$698.75	$235.13	$120.63	$3.25	$69.75		$5,856.73
$11.65	$4,481.85	$240.57	-$191.37	$287.62	$792.58	$804.58	$270.74	$138.90	$3.75	$69.60		$6,910.47
$11.65	$4,908.56	$217.44	-$172.98	$269.64	$773.12	$727.24	$244.72	$125.55	$3.39	$69.87		$7,178.20
$11.65	$6,683.42	$268.15	-$154.08	$319.22	$1,057.66	$896.84	$301.79	$154.83	$4.18	$72.12		$9,615.78
$11.65	$8,052.95	$320.89	-$179.21	$370.78	$931.35	$1,073.23	$361.14	$185.28	$5.00	$72.36		$11,205.42
$11.65	$6,556.38	$261.26	-$145.90	$312.48	$861.95	$873.78	$294.02	$150.85	$4.07	$72.36		$9,252.90
$11.65	$5,649.05	$263.29	-$422.69	$309.83	$857.92	$880.56	$296.31	$152.02	$4.10	$70.89		$8,072.93
$11.65	$5,239.95	$257.11	-$418.13	$291.19	$829.45	$816.79	$281.99	$141.01	$3.80	$70.75		$7,525.56
$11.65	$5,126.80	$252.00	-$398.57	$286.03	$636.00	$799.16	$303.64	$137.97	$3.72	$70.89		$7,229.29
$11.65	$4,439.16	$218.20	-$56.14	$254.70	$854.04	$691.97	$262.92	$119.46	$3.22	$72.08		$6,871.26
$139.80	$63,926.12	$2,990.94	-$1,951.81	$3,529.84	$9,194.75	$9,859.85	$3,389.77	$1,702.20	$45.92	$852.71		$93,680.09

Electric Usage - Township of Roxbury Town Hall/Police Department



Utility Data - RoxburyMunicipal(rev-3).xls
Electricity Chart

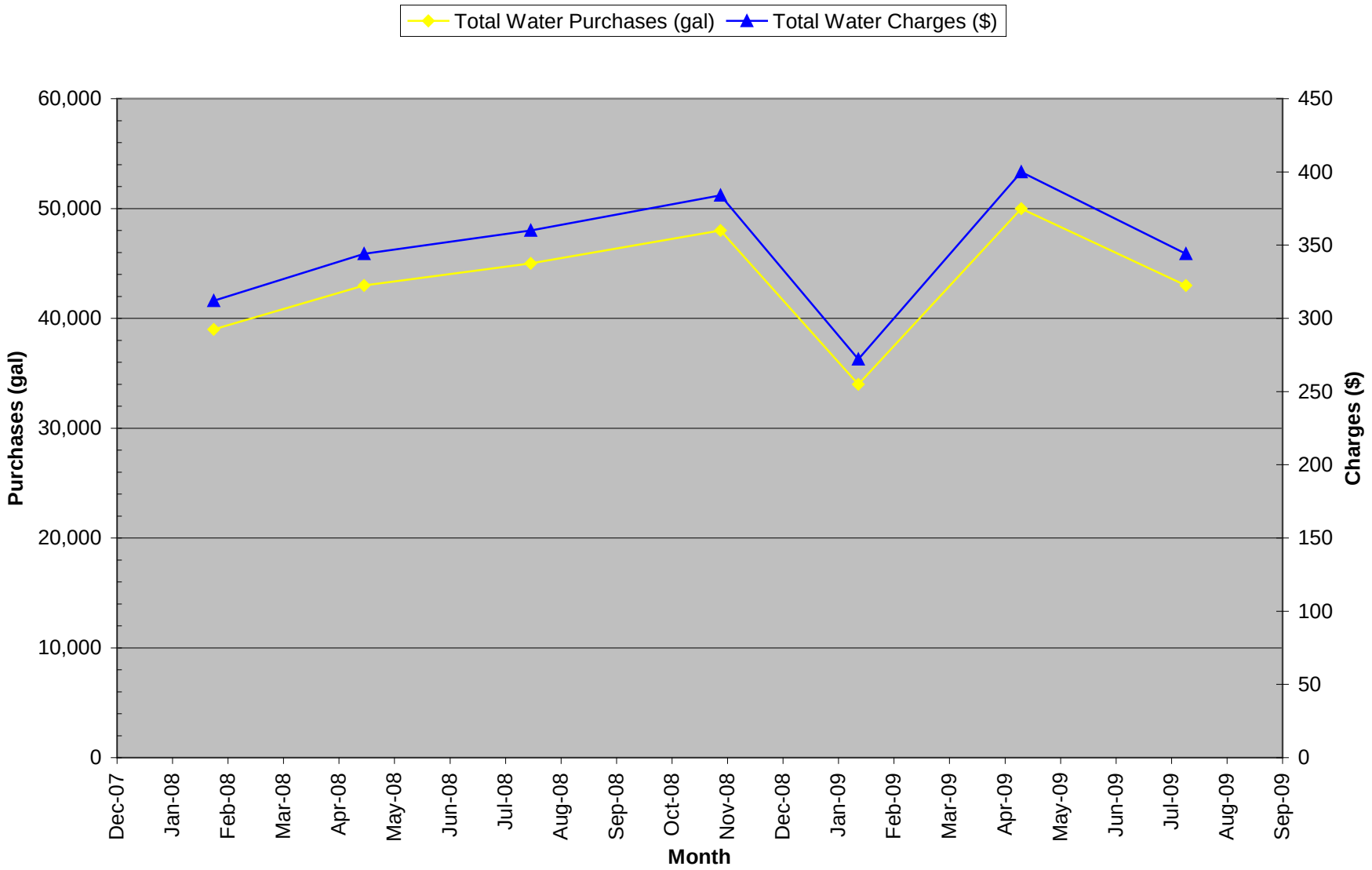
New Jersey BPU Energy Audit Program
CHA Project No. 20556
Building: Roxbury Township Town Hall/Police Department

Water

Month	Charges ($)	Total Usage (gallons)	Rate ($/1000 Gal)
2/8/08	312	39,000	8.00
5/2/08	344	43,000	8.00
8/3/08	360	45,000	8.00
11/17/08	384	48,000	8.00
2/2/09	272	34,000	8.00
5/4/09	400	50,000	8.00
8/4/09	344	43,000	8.00
Total	$ 2,416	$ 302,000	$8.00
Total (2008)	$ 1,400	$ 175,000	$8.00

Rate not provided by Roxbury Township. Estimated at $8.00 per 1000 gallons.

Water Usage - Township of Roxbury Town Hall/Police Department



Utility Data - RoxburyMunicipal(rev-3).xls
Water Chart

APPENDIX B

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #20556
Township of Roxbury
Equipment Inventory - Town Hall / Police Department

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy (years)	Other Info.
RTU #1	Carrier	48TJE028, Series 600QA (S/N 4595F78154)	Roof Top Unit AC/Heating	Cooling - 25 tons Heating Input - 485,000 Btu/hr (142.1 kW) natural gas 80% Efficiency	Roof (s/w corner)	Police Chief	Nov-95	Nearing useful life expectancy	R-22: 16.8lb + 15.8lb Integrated Economizer * Had been experiencing problems recently (leaks, vibrations, no AC)
RTU #2	Carrier	48TJF012, Series 611AA (S/N 4895G30146)	Roof Top Unit AC/Heating	Input - 250,000 Btu/hr (73.3 kW) natural gas 80% Efficiency	Roof (north side)	Courtroom	Nov-95	Nearing useful life expectancy	R-22: 5.8lb + 5.9lb
RTU #3	Carrier	48TMF025, Series 611AA (S/N 1306U06052)	Roof Top Unit AC/Heating	Input - 360,000 Btu/hr (105.4 kW) natural gas 81% Efficiency	Roof (north side)	Police Records	Mar-06	11	R-22: 19.7lb + 13.9lb
RTU #4	Lennox	LGA240SS1G (S/N 5601B 02659)	Roof Top Unit AC/Heating	Cooling - 20 Ton Input - 260,000 Btu/hr (76.2 kW) natural gas 80% Efficiency	Roof (n/e corner)	Council Room	Feb-01	6	HCFC-22: 40lb
RTU #5	Lennox	LGA300SS1G (S/N 5601K 00138)	Roof Top Unit AC/Heating	Cooling - 20 Ton Input - 260,000 Btu/hr (76.2 kW) natural gas 80% Efficiency	Roof (n/e corner)	Engineering	Nov-01	7	HCFC-22: 44lb
Sanyo Split System	Sanyo	CL1872/KS1872 (S/N 0002101)	Split System AC	17,500 Btu/hr (5.15 kW) 1,500 W, 94% power factor	Roof	Computer Room	2009	15	2.87 lbs R-410A SEER 16
Mitsubishi Split System	Mitsubishi	MUZ-A17NA/MSZ-A17NA (S/N 7002104T)	Split System Heat Pump	Cooling - 16,200 Btu/hr, 2,070 W Heating - 20,100 Btu/hr, 2,150 W	Roof (s/w corner)	Police Dispatch	2009	15	2 lbs 7 oz R-410A SEER 16
Exhaust Fan	Fumex	FX8BFT	Belt Drive Exhaust Fan	Maximum HP: 3/4	Roof (west side)	Police locker room, cells	1996	6	Fan operating constantly during survey
Exhaust Fans (2)	JennAir	184BCR	Belt Drive Exhaust Fan	-	Roof (n/w corner)	Bathrooms	1996	Not used	Both fans no longer being used
Exhaust Fans (2)	JennAir	142BOR	Belt Drive Exhaust Fan	-	Roof (n/e corner)	n/a	unknown	Not used	Both fans no longer being used
Emergency Generator	Kohler	80RZ82 (S/N 370654S)	Emergency Generator	80 kW	Outside	Police Dept., emergency ligthing, elevator	1996	6	Natural Gas fired
Hot Water Heater		DRE 80 917 (S/N ME97-0654021-917)	HW Heater/Tank	80 gallons	Utility Room	Entire Building	1997	7	Natural Gas fired
Portable Plug-in Space Heaters	varies	varies	Space heater	varies	Perimeter Offices	Perimeter Offices	varies	varies	Approximately 20 units

APPENDIX C

ECM-1a Lighting Replacements

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

Existing Lighting

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	Retrofit control device	(kW/space) * (Annual Hours)	Notes
237	Rear Parking Lot Poles	10	WP 400 Po HPS	hps400/1	465	4.7	Breaker	4368	None	20,311	
237	Police Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	None	12,187	
230	Police Loading Sallyport Door	1	WP400MH1	MH400/1	458	0.5	SW	4368	None	2,001	
230	Police Side of Building	3	WP400MH1	MH400/1	458	1.4	SW	4368	None	6,002	
8	Police Entrance Door	1	MH 175	MH175/1	215	0.2	SW	4368	None	939	
226	Police Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	None	830	
226	Town Hall Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	None	830	
226	Flag Pole	3	70 W MH	MH70/1	95	0.3	SW	4368	None	1,245	
226	Front Doors	2	70 W MH	MH70/1	95	0.2	SW	4368	None	830	
140	Town Hall Side Exterior Wall	3	WPMH 175	MH175/1	215	0.6	SW	4368	None	2,817	
237	Town Hall Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	None	12,187	
64	Main Public Entrance	2	SP 175 R MH	MH175/1	215	0.4	SW	4368	None	1,878	
5	Town Hall Corridors	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	SW	8760	None	26,280	
5	Town Hall Corridors	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	Breaker	8760	None	9,461	
208	Town Hall Corridors	17	SP 26 R CF 2	CFQ25/2	66	1.1	SW	8760	None	9,829	
X1	Town Hall Corridors	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	None	92	
X2	Town Hall Corridors	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	SW	8760	None	26	
204	Town Hall Corridors	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	8760	None	3,627	
193	Town Hall Corridors	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	8760	None	631	
18	Administration Office	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	C-OCC	2600	None	2,621	
5	Administration Office	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	C-OCC	2600	None	468	
18	Administration Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	None	582	
5	Administration Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	None	312	
5	Clerk's Office	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	OCC	624	
18	Manager's Office	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	2600	OCC	2,330	
18	Front Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2000	C-OCC	1,344	
5	Council Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2000	None	120	
18	Council Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2000	None	224	
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	None	3,360	
18	Council Room	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	SW	2000	None	4,032	
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	None	3,360	
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	None	3,360	
208	Council Room	5	SP 26 R CF 2	CFQ25/2	66	0.3	SW	2000	None	660	
208	Council Room	3	SP 26 R CF 2	CFQ25/2	66	0.2	SW	2000	None	396	
X1	Council Room Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	None	26	
201	Admin. File Storage	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	C-OCC	360	
18	Back Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2000	None	1,344	
201	Technical Director	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	OCC	702	
18	Computer Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	None	582	
18	Court Conference Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	OCC	448	
201	Front Supply Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	None	360	
5	Emergency Management	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	None	156	
201	Emergency Management	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	None	702	
18	Lunch Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	3103	None	1,390	

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

Existing Lighting

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	Retrofit control device	(kW/space) * (Annual Hours)	Notes
5	Lunch Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	3103	None	186	
18	Lunch Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	3103	None	347	
18	Constructio Code Official's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	C-OCC	582	
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	None	1,456	
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	None	1,456	
18	Building Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	2600	None	1,747	
5	Building Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	None	312	
208	Building Office	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	None	343	
18	Planning	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	2600	None	874	
5	Planning	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	None	156	
18	Planning	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	None	291	
18	Planning	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	None	582	
5	Planning	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	None	312	
18	Township Planner	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	None	874	
201	Zoning Officer	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2600	None	468	
18	Planning Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	None	582	
18	Finance Directors Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	OCC	582	
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	2600	OCC	291	
5	Finance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	OCC	312	
18	Finance	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	None	582	
5	Finance	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	C-OCC	2600	None	780	
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	None	291	
5	Finance	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	None	156	
18	Engineering Director's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2600	OCC	1,747	
18	Engineering Reproduction	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	OCC	1,165	
18	Township Engineer's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2600	None	1,747	
18	Four Engineering Workstations	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	None	582	
18	Four Engineering Workstations	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2600	None	2,912	
18	Drafting Computer Area	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	None	582	
18	Public Works	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	C-OCC	1,165	
18	Recycling Coordination	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	C-OCC	2600	None	874	
18	Engineer's Secretary	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	None	582	
201	Fire Official's Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	C-OCC	1,404	
201	Rear Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	None	90	
201	Court Room Closet	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	None	90	
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2000	None	448	
18	Court Room	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2000	None	2,240	
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	None	448	
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	None	896	
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	None	896	
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	None	2,038	
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	None	2,038	
5	Judge's Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	C-OCC	8760	None	1,051	Occ Sensor does not work, lights stay on
5	Judge's Bathroom	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2080	OCC	125	

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

Existing Lighting

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	Retrofit control device	(kW/space) * (Annual Hours)	Notes
201	Court Clerk's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	Breaker	8760	OCC	1,577	
201	Storage Room (Next to Court Clerk)	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1000	None	360	
204	Water Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	1000	None	207	
204	Tax Storage Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	2000	None	414	
193	Furnace Room	2	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	1000	None	144	
193	Electric Room & Communications	4	W 34 P F 2 (MAG)	F42EE	72	0.3	SW	1000	None	288	
18	Tax Collector's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	OCC	582	
18	Tax Assessor's Office	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	OCC	874	
18	Utilities Office	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	SW	2600	None	6,115	
18	Utilities Office	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	None	291	
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	2080	None	187	
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	None	150	
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	Breaker	2080	None	187	
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	Breaker	2080	None	150	
201	Women's Bathroom	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2080	None	562	
5	Tax Department Entrance	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	None	468	
208	Tax Department Entrance	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	None	343	
5	Tax Department Entrance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	None	312	
5	Maintenance Closet	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	1000	None	120	
20	Police ESU Supp.	1	S 32 C F 1 (ELE)	F41LL	32	0.0	SW	8760	None	280	
191	Secure Weapons Storage	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	SW	8760	None	2,155	
18	ESU/Comm. Services	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	None	7,849	
18	LT. Offices	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	8760	None	3,924	
18	Captain's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	OCC	1,962	
201	Chief's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	8760	None	1,577	
201	Police Conference Room	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	OCC	4,730	
201	Police Traffic Division	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	OCC	4,730	
208	Dispatch Office	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	None	578	
18	Dispatch Office	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	None	3,924	
201	Public Bathroom (Police Building)	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	OCC	2080	None	187	
5	Public Entry	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	Breaker	8760	None	3,154	
201	D.B. Interview	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	None	788	
201	Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	None	788	
18	Detectives Division	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	8760	None	5,887	
18	Detectives Division	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	8760	None	2,943	
18	Squad Room/Patrol Sgt./Patrol Lt.	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	SW	8760	None	15,698	
191	Secure Storage	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	SW	8760	None	4,310	
18	Records Division	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	None	7,849	
201	Records Storage Division	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	None	2,365	
18	Patrol Storage	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	None	1,962	
18	Police Exercise Room	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	8760	None	7,849	
18	Police Women's Locker Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	None	3,924	
18	Police Men's Locker Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	None	981	
18	Police Men's Locker Room	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	SW	8760	None	6,868	

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

Existing Lighting

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	Retrofit control device	(kW/space) * (Annual Hours)	Notes
208	Police Men's Locker Room	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	None	578	
47	Cell Block	4	1B 34 C F 3(MAG)	F43EE	115	0.5	Breaker	8760	None	4,030	
18	Inmate's Bathroom	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	OCC	981	
18	Inmate Processing	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	SW	8760	None	4,906	
18	Inmate Processing	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	8760	None	981	
201	Police File Storage	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	None	2,365	
5	Police Corridors	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	SW	8760	None	19,973	
5	Police Corridors	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	Breaker	8760	None	5,256	
204	Police Drive Thru Sallyport	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	None	1,813	
	Total	**639**				**69.4**				**330,031**	

Energy Audit of Roxbury Township
CHA Project No. 20556 - Town Hall/Police Department
ECM-1 - Fixture and Control Replacement Cost Lighting Analysis

COST TABLE

Notes	Field Code	Standard Code	NYSERDA Code	Watts per fixture	Retrofit	Standard Code	NYSERDA Code	Watts per fixture	Lamps/Fix	Ball/Fix	Fixture Replacement			Ballast Replacement			Lamp Replacement			O.P.& D	NJ Incentive	Retrofit Cost (inc. O&P)
											Material	Labor	Disposal	Material	Labor	Disposal	Material	Labor	Disposal			
	X1	X 1.5 W LED	ELED1.5/1	1.5	NONE															$0.00		**$0.00**
	X2	XX 3.0 W CF 2	ELED1.5/2	3	NONE															$0.00		**$0.00**
	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	NONE																	**$0.00**
	8	MH 175	MH175/1	215	NONE															$0.00		**$0.00**
	18	T 32 R F 4 (ELE)	F44ILL	112	NONE																	**$0.00**
	38	T 32 R F 2 (ELE)	F42LL	60	NONE															$0.00		**$0.00**
	64	SP 175 R MH	MH175/1	215	NONE															$0.00		**$0.00**
	140	WPMH 175	MH175/1	215	NONE																	
	191	S 60 P F 2 (ELE) 8'	F82EE	123	NONE															$0.00		**$0.00**
	193	W 34 P F 2 (MAG)	F42EE	72	RL/RB	W 28 P F 2	F42SSILL	48						$20.00	$45.00	INC	$10.00	$10.00	INC	$29.75	**$10.00**	**$114.75**
	201	T 32 R F 3 (ELE)	F43ILL/2	90	NONE															$0.00		**$0.00**
	204	S 96 P F 2 (MAG) 8'	F82EHE	207	NONE	S 60 P F 2 (ELE) 8'	F82LHL	160														
	208	SP 26 R CF 2	CFQ25/2	66	NONE															$0.00		**$0.00**
	226	70 W MH	MH70/1	95	NONE																	
	230	WP400MH1	MH400/1	458	NONE																	
	237	WP 400 Po HPS	hps400/1	465	NONE																	**$0.00**
	OCC	OCCUPANCY SENSOR SWITCH									$50	$45	INC							$23.75	**$20.00**	**$118.75**
	C-OCC	OCC SENSOR W/ 20 FT. WIRE TO CEILING									$100	$50	INC							$52.50	**$35.00**	**$202.50**

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

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

Energy Audit of Roxbury Township
CHA Project No. 20556 - Town Hall/Police Department
ECM 1 - Fixture and Control Replacement Cost Lighting Analysis

Hours of Operation

Energy Audit of Roxbury Township	Hours/Day	Hours/Year	Proposed	Utilized
Hallways	24	8760	8760	Y
Offices	10	2600	1200	Y
Outdoor Lighting	12	4368	4368	Y
Storage Areas (less frequently used)		1000	250	Y
Bath Room	8	2080	1000	Y
Break/Lunch Rooms	8.5	3103	1500	Y
Linen/Utility/Wet/Janitor/Electrical	3	1000	500	Y
Storage	6	2000	1000	Y
Conference	6	2000	1000	Y
Offices with bad controls (24 hours)	24	8760	1200	Y
Police Building	24	8760	2600	Y

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1a Lighting Replacements

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
237	Rear Parking Lot Poles	10	WP 400 Po HPS	hps400/1	465	4.7	Breaker	4368	20,311	10	WP 400 Po HPS	hps400/1	465	4.7	Breaker	4,368	20,311	-	-	$ -	$ -	$0		
237	Police Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,187	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4,368	12,187	-	-	$ -	$ -	$0		
230	Police Loading Sallyport Door	1	WP400MH1	MH400/1	458	0.5	SW	4368	2,001	1	WP400MH1	MH400/1	458	0.5	SW	4,368	2,001	-	-	$ -	$ -	$0		
230	Police Side of Building	3	WP400MH1	MH400/1	458	1.4	SW	4368	6,002	3	WP400MH1	MH400/1	458	1.4	SW	4,368	6,002	-	-	$ -	$ -	$0		
8	Police Entrance Door	1	MH 175	MH175/1	215	0.2	SW	4368	939	1	MH 175	MH175/1	215	0.2	SW	4,368	939	-	-	$ -	$ -	$0		
226	Police Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	SW	4,368	830	-	-	$ -	$ -	$0		
226	Town Hall Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	SW	4,368	830	-	-	$ -	$ -	$0		
226	Flag Pole	3	70 W MH	MH70/1	95	0.3	SW	4368	1,245	3	70 W MH	MH70/1	95	0.3	SW	4,368	1,245	-	-	$ -	$ -	$0		
226	Front Doors	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	SW	4,368	830	-	-	$ -	$ -	$0		
140	Town Hall Side Exterior Wall	3	WPMH 175	MH175/1	215	0.6	SW	4368	2,817	3	WPMH 175	MH175/1	215	0.6	SW	4,368	2,817	-	-	$ -	$ -	$0		
237	Town Hall Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,187	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4,368	12,187	-	-	$ -	$ -	$0		
64	Main Public Entrance	2	SP 175 R MH	MH175/1	215	0.4	SW	4368	1,878	2	SP 175 R MH	MH175/1	215	0.4	SW	4,368	1,878	-	-	$ -	$ -	$0		
5	Town Hall Corridors	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	SW	8760	26,280	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	SW	8,760	26,280	-	-	$ -	$ -	$0		
5	Town Hall Corridors	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	Breaker	8760	9,461	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	Breaker	8,760	9,461	-	-	$ -	$ -	$0		
208	Town Hall Corridors	17	SP 26 R CF 2	CFQ25/2	66	1.1	SW	8760	9,829	17	SP 26 R CF 2	CFQ25/2	66	1.1	SW	8,760	9,829	-	-	$ -	$ -	$0		
X1	Town Hall Corridors	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	92	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8,760	92	-	-	$ -	$ -	$0		
X2	Town Hall Corridors	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	SW	8760	26	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	SW	8,760	26	-	-	$ -	$ -	$0		
204	Town Hall Corridors	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	8760	3,627	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	8,760	3,627	-	-	$ -	$ -	$0		
193	Town Hall Corridors	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	8760	631	1	W 28 P F 2	F42SSILL	48	0.0	SW	8,760	420	210	0.0	$ 32.30	$ 114.75	$10	3.6	3.2
18	Administration Office	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	C-OCC	2600	2,621	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	C-OCC	2,600	2,621	-	-	$ -	$ -	$0		
5	Administration Office	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	C-OCC	2600	468	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	C-OCC	2,600	468	-	-	$ -	$ -	$0		
18	Administration Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2,600	582	-	-	$ -	$ -	$0		
5	Administration Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2,600	312	-	-	$ -	$ -	$0		
5	Clerk's Office	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	624	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2,600	624	-	-	$ -	$ -	$0		
18	Manager's Office	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	2600	2,330	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	2,600	2,330	-	-	$ -	$ -	$0		
18	Front Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2000	1,344	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2,000	1,344	-	-	$ -	$ -	$0		
5	Council Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2000	120	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2,000	120	-	-	$ -	$ -	$0		
18	Council Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2000	224	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2,000	224	-	-	$ -	$ -	$0		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2,000	3,360	-	-	$ -	$ -	$0		
18	Council Room	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	SW	2000	4,032	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	SW	2,000	4,032	-	-	$ -	$ -	$0		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2,000	3,360	-	-	$ -	$ -	$0		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2,000	3,360	-	-	$ -	$ -	$0		
208	Council Room	5	SP 26 R CF 2	CFQ25/2	66	0.3	SW	2000	660	5	SP 26 R CF 2	CFQ25/2	66	0.3	SW	2,000	660	-	-	$ -	$ -	$0		
208	Council Room	3	SP 26 R CF 2	CFQ25/2	66	0.2	SW	2000	396	3	SP 26 R CF 2	CFQ25/2	66	0.2	SW	2,000	396	-	-	$ -	$ -	$0		
X1	Council Room Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8,760	26	-	-	$ -	$ -	$0		
201	Admin. File Storage	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,000	360	-	-	$ -	$ -	$0		
18	Back Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2000	1,344	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2,000	1,344	-	-	$ -	$ -	$0		
201	Technical Director	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2,600	702	-	-	$ -	$ -	$0		
18	Computer Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,600	582	-	-	$ -	$ -	$0		
18	Court Conference Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,000	448	-	-	$ -	$ -	$0		
201	Front Supply Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2,000	360	-	-	$ -	$ -	$0		
5	Emergency Management	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2,600	156	-	-	$ -	$ -	$0		
201	Emergency Management	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2,600	702	-	-	$ -	$ -	$0		
18	Lunch Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	3102.5	1,390	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	3,103	1,390	-	-	$ -	$ -	$0		
5	Lunch Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	3102.5	186	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	3,103	186	-	-	$ -	$ -	$0		
18	Lunch Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	3102.5	347	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	3,103	347	-	-	$ -	$ -	$0		
18	Constructio Code Official's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,600	582	-	-	$ -	$ -	$0		
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2,600	1,456	-	-	$ -	$ -	$0		
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2,600	1,456	-	-	$ -	$ -	$0		
18	Building Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	2,600	1,747	-	-	$ -	$ -	$0		
5	Building Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2,600	312	-	-	$ -	$ -	$0		
208	Building Office	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2,600	343	-	-	$ -	$ -	$0		
18	Planning	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	2,600	874	-	-	$ -	$ -	$0		
5	Planning	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2,600	156	-	-	$ -	$ -	$0		
18	Planning	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2,600	291	-	-	$ -	$ -	$0		
18	Planning	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2,600	582	-	-	$ -	$ -	$0		
5	Planning	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2,600	312	-	-	$ -	$ -	$0		
18	Township Planner	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2,600	874	-	-	$ -	$ -	$0		
201	Zoning Officer	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2,600	468	-	-	$ -	$ -	$0		
18	Planning Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2,600	582	-	-	$ -	$ -	$0		
18	Finance Directors Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,600	582	-	-	$ -	$ -	$0		
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	2,600	291	-	-	$ -	$ -	$0		
5	Finance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2,600	312	-	-	$ -	$ -	$0		
18	Finance	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2,600	582	-	-	$ -	$ -	$0		
5	Finance	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	C-OCC	2600	780	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	C-OCC	2,600	780	-	-	$ -	$ -	$0		
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2,600	291	-	-	$ -	$ -	$0		
5	Finance	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2,600	156	-	-	$ -	$ -	$0		
18	Engineering Director's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2,600	1,747	-	-	$ -	$ -	$0		
18	Engineering Reproduction	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,165	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2,600	1,165	-	-	$ -	$ -	$0		
18	Township Engineer's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2,600	1,747	-	-	$ -	$ -	$0		
18	Four Engineering Workstations	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2,600	582	-	-	$ -	$ -	$0		
18	Four Engineering Workstations	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2600	2,912	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2,600	2,912	-	-	$ -	$ -	$0		
18	Drafting Computer Area	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2,600	582	-	-	$ -	$ -	$0		
18	Public Works	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,165	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2,600	1,165	-	-	$ -	$ -	$0		
18	Recycling Coordination	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	C-OCC	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	C-OCC	2,600	874	-	-	$ -	$ -	$0		
18	Engineer's Secretary	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2,600	582	-	-	$ -	$ -	$0		
201	Fire Official's Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	1,404	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2,600	1,404	-	-	$ -	$ -	$0		
201	Rear Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1,000	90	-	-	$ -	$ -	$0		
201	Court Room Closet	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1,000	90	-	-	$ -	$ -	$0		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2,000	448	-	-	$ -	$ -	$0		
18	Court Room	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2000	2,240	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2,000	2,240	-	-	$ -	$ -	$0		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,000	448	-	-	$ -	$ -	$0		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2,000	896	-	-	$ -	$ -	$0		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2,000	896	-	-	$ -	$ -	$0		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2,600	2,038	-	-	$ -	$ -	$0		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2,600	2,038	-	-	$ -	$ -	$0		
5	Judge's Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	C-OCC	8760	1,051	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	C-OCC	8,760	1,051	-	-	$ -	$ -	$0		

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1a Lighting Replacements

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
5	Judge's Bathroom	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2080	125	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2,080	125	-	-	$ -	$ -	$0		
201	Court Clerk's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	Breaker	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	Breaker	8,760	1,577	-	-	$ -	$ -	$0		
201	Storage Room (Next to Court Clerk)	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1000	360	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1,000	360	-	-	$ -	$ -	$0		
204	Water Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	1000	207	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	1,000	207	-	-	$ -	$ -	$0		
204	Tax Storage Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	2000	414	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	2,000	414	-	-	$ -	$ -	$0		
193	Furnace Room	2	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	W 28 P F 2	F42SSILL	48	0.1	SW	1,000	96	48	0.0	$ 10.48	$ 229.50	$20	21.9	20.0
193	Electric Room & Communications	4	W 34 P F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	W 28 P F 2	F42SSILL	48	0.2	SW	1,000	192	96	0.1	$ 20.95	$ 459.00	$40	21.9	20.0
18	Tax Collector's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2,600	582	-	-	$ -	$ -	$0		
18	Tax Assessor's Office	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2,600	874	-	-	$ -	$ -	$0		
18	Utilities Office	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	SW	2600	6,115	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	SW	2,600	6,115	-	-	$ -	$ -	$0		
18	Utilities Office	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2,600	291	-	-	$ -	$ -	$0		
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	2,080	187	-	-	$ -	$ -	$0		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	150	1	W 28 P F 2	F42SSILL	48	0.0	SW	2,080	100	50	0.0	$ 9.00	$ 114.75	$10	12.7	11.6
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	Breaker	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	Breaker	2,080	187	-	-	$ -	$ -	$0		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	Breaker	2080	150	1	W 28 P F 2	F42SSILL	48	0.0	Breaker	2,080	100	50	0.0	$ 9.00	$ 114.75	$10	12.7	11.6
201	Women's Bathroom	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2080	562	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2,080	562	-	-	$ -	$ -	$0		
5	Tax Department Entrance	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	468	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2,600	468	-	-	$ -	$ -	$0		
208	Tax Department Entrance	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2,600	343	-	-	$ -	$ -	$0		
5	Tax Department Entrance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2,600	312	-	-	$ -	$ -	$0		
5	Maintenance Closet	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	1000	120	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	1,000	120	-	-	$ -	$ -	$0		
20	Police ESU Supp.	1	S 32 C F 1 (ELE)	F41LL	32	0.0	SW	8760	280	1	S 32 C F 1 (ELE)	F41LL	32	0.0	SW	8,760	280	-	-	$ -	$ -	$0		
191	Secure Weapons Storage	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	SW	8760	2,155	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	SW	8,760	2,155	-	-	$ -	$ -	$0		
18	ESU/Comm. Services	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8,760	7,849	-	-	$ -	$ -	$0		
18	LT. Offices	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	8,760	3,924	-	-	$ -	$ -	$0		
18	Captain's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8,760	1,962	-	-	$ -	$ -	$0		
201	Chief's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	8,760	1,577	-	-	$ -	$ -	$0		
201	Police Conference Room	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8,760	4,730	-	-	$ -	$ -	$0		
201	Police Traffic Division	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8,760	4,730	-	-	$ -	$ -	$0		
208	Dispatch Office	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8,760	578	-	-	$ -	$ -	$0		
18	Dispatch Office	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8,760	3,924	-	-	$ -	$ -	$0		
201	Public Bathroom (Police Building)	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	OCC	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	OCC	2,080	187	-	-	$ -	$ -	$0		
5	Public Entry	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	Breaker	8760	3,154	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	Breaker	8,760	3,154	-	-	$ -	$ -	$0		
201	D.B. Interview	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8,760	788	-	-	$ -	$ -	$0		
201	Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8,760	788	-	-	$ -	$ -	$0		
18	Detectives Division	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	8760	5,887	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	8,760	5,887	-	-	$ -	$ -	$0		
18	Detectives Division	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	8760	2,943	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	8,760	2,943	-	-	$ -	$ -	$0		
18	Squad Room/Patrol Sgt./Patrol Lt.	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	SW	8760	15,698	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	SW	8,760	15,698	-	-	$ -	$ -	$0		
191	Secure Storage	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	SW	8760	4,310	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	SW	8,760	4,310	-	-	$ -	$ -	$0		
18	Records Division	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8,760	7,849	-	-	$ -	$ -	$0		
201	Records Storage Division	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8,760	2,365	-	-	$ -	$ -	$0		
18	Patrol Storage	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8,760	1,962	-	-	$ -	$ -	$0		
18	Police Exercise Room	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	8,760	7,849	-	-	$ -	$ -	$0		
18	Police Women's Locker Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8,760	3,924	-	-	$ -	$ -	$0		
18	Police Men's Locker Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8,760	981	-	-	$ -	$ -	$0		
18	Police Men's Locker Room	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	SW	8760	6,868	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	SW	8,760	6,868	-	-	$ -	$ -	$0		
208	Police Men's Locker Room	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8,760	578	-	-	$ -	$ -	$0		
47	Cell Block	4	1B 34 C F 3(MAG)	F43EE	115	0.5	Breaker	8760	4,030	4	1B 28 C F 3	F43SSILL	72	0.3	Breaker	8,760	2,523	1,507	0.2	$ 231.48	$ 513.00	$0	2.2	2.2
18	Inmate's Bathroom	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8,760	981	-	-	$ -	$ -	$0		
18	Inmate Processing	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	SW	8760	4,906	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	SW	8,760	4,906	-	-	$ -	$ -	$0		
18	Inmate Processing	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	8,760	981	-	-	$ -	$ -	$0		
201	Police File Storage	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8,760	2,365	-	-	$ -	$ -	$0		
5	Police Corridors	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	SW	8760	19,973	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	SW	8,760	19,973	-	-	$ -	$ -	$0		
5	Police Corridors	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	Breaker	8760	5,256	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	Breaker	8,760	5,256	-	-	$ -	$ -	$0		
204	Police Drive Thru Sallyport	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	1,813	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	8,760	1,813	-	-	$ -	$ -	$0		
	Total	**639**				**69.4**			**330,031**	**639**			**15,488**	**69**			**328,070**	**1,961**	**0.4**	**$313**	**$1,546**	**$90**		
																	Demand Savings			**0.4**	**$28**			
																	kWh Savings			**1,961**	**$285**			
																	Total savings				**$313**		**4.9**	**4.6**

APPENDIX D

ECM-1b Install Occupancy Sensors

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1b Install Occupancy Sensors

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
237	Rear Parking Lot Poles	10	WP 400 Po HPS	hps400/1	465	4.7	Breaker	4368	20,311.2	10	WP 400 Po HPS	hps400/1	465	4.7	None	4368	20,311.2	0.0	0.0	$0.00	$0.00	$0.00		
237	Police Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,186.7	6	WP 400 Po HPS	hps400/1	465	2.8	None	4368	12,186.7	0.0	0.0	$0.00	$0.00	$0.00		
230	Police Loading Sallyport Door	1	WP400MH1	MH400/1	458	0.5	SW	4368	2,000.5	1	WP400MH1	MH400/1	458	0.5	None	4368	2,000.5	0.0	0.0	$0.00	$0.00	$0.00		
230	Police Side of Building	3	WP400MH1	MH400/1	458	1.4	SW	4368	6,001.6	3	WP400MH1	MH400/1	458	1.4	None	4368	6,001.6	0.0	0.0	$0.00	$0.00	$0.00		
8	Police Entrance Door	1	MH 175	MH175/1	215	0.2	SW	4368	939.1	1	MH 175	MH175/1	215	0.2	None	4368	939.1	0.0	0.0	$0.00	$0.00	$0.00		
226	Police Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	829.9	2	70 W MH	MH70/1	95	0.2	None	4368	829.9	0.0	0.0	$0.00	$0.00	$0.00		
226	Town Hall Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	829.9	2	70 W MH	MH70/1	95	0.2	None	4368	829.9	0.0	0.0	$0.00	$0.00	$0.00		
226	Flag Pole	3	70 W MH	MH70/1	95	0.3	SW	4368	1,244.9	3	70 W MH	MH70/1	95	0.3	None	4368	1,244.9	0.0	0.0	$0.00	$0.00	$0.00		
226	Front Doors	2	70 W MH	MH70/1	95	0.2	SW	4368	829.9	2	70 W MH	MH70/1	95	0.2	None	4368	829.9	0.0	0.0	$0.00	$0.00	$0.00		
140	Town Hall Side Exterior Wall	3	WPMH 175	MH175/1	215	0.6	SW	4368	2,817.4	3	WPMH 175	MH175/1	215	0.6	None	4368	2,817.4	0.0	0.0	$0.00	$0.00	$0.00		
237	Town Hall Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,186.7	6	WP 400 Po HPS	hps400/1	465	2.8	None	4368	12,186.7	0.0	0.0	$0.00	$0.00	$0.00		
64	Main Public Entrance	2	SP 175 R MH	MH175/1	215	0.4	SW	4368	1,878.2	2	SP 175 R MH	MH175/1	215	0.4	None	4368	1,878.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Town Hall Corridors	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	SW	8760	26,280.0	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	None	8760	26,280.0	0.0	0.0	$0.00	$0.00	$0.00		
5	Town Hall Corridors	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	Breaker	8760	9,460.8	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	None	8760	9,460.8	0.0	0.0	$0.00	$0.00	$0.00		
208	Town Hall Corridors	17	SP 26 R CF 2	CFQ25/2	66	1.1	SW	8760	9,828.7	17	SP 26 R CF 2	CFQ25/2	66	1.1	None	8760	9,828.7	0.0	0.0	$0.00	$0.00	$0.00		
X1	Town Hall Corridors	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	92.0	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	92.0	0.0	0.0	$0.00	$0.00	$0.00		
X2	Town Hall Corridors	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	SW	8760	26.3	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	None	8760	26.3	0.0	0.0	$0.00	$0.00	$0.00		
204	Town Hall Corridors	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	8760	3,626.6	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	None	8760	3,626.6	0.0	0.0	$0.00	$0.00	$0.00		
193	Town Hall Corridors	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	8760	630.7	1	W 34 P F 2 (MAG)	F42EE	72	0.1	None	8760	630.7	0.0	0.0	$0.00	$0.00	$0.00		
18	Administration Office	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	C-OCC	2600	2,620.8	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	None	2600	2,620.8	0.0	0.0	$0.00	$0.00	$0.00		
5	Administration Office	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	C-OCC	2600	468.0	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Administration Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
5	Administration Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
5	Clerk's Office	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	624.0	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	OCC	1200	288.0	336.0	0.0	$48.82	$237.50	$40.00	4.9	4.0
18	Manager's Office	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	2600	2,329.6	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	1200	1,075.2	1,254.4	0.0	$182.26	$237.50	$40.00	1.3	1.1
18	Front Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2000	1,344.0	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	1000	672.0	672.0	0.0	$97.64	$405.00	$70.00	4.1	3.4
5	Council Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2000	120.0	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2000	120.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Council Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2000	224.0	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2000	224.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360.0	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	None	2000	3,360.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Council Room	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	SW	2000	4,032.0	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	None	2000	4,032.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360.0	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	None	2000	3,360.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360.0	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	None	2000	3,360.0	0.0	0.0	$0.00	$0.00	$0.00		
208	Council Room	5	SP 26 R CF 2	CFQ25/2	66	0.3	SW	2000	660.0	5	SP 26 R CF 2	CFQ25/2	66	0.3	None	2000	660.0	0.0	0.0	$0.00	$0.00	$0.00		
208	Council Room	3	SP 26 R CF 2	CFQ25/2	66	0.2	SW	2000	396.0	3	SP 26 R CF 2	CFQ25/2	66	0.2	None	2000	396.0	0.0	0.0	$0.00	$0.00	$0.00		
X1	Council Room Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26.3	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8760	26.3	0.0	0.0	$0.00	$0.00	$0.00		
201	Admin. File Storage	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	1000	180.0	180.0	0.0	$26.15	$202.50	$35.00	7.7	6.4
18	Back Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2000	1,344.0	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2000	1,344.0	0.0	0.0	$0.00	$0.00	$0.00		
201	Technical Director	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702.0	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	OCC	1200	324.0	378.0	0.0	$54.92	$118.75	$20.00	2.2	1.8
18	Computer Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Conference Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448.0	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1000	224.0	224.0	0.0	$32.55	$118.75	$20.00	3.6	3.0
201	Front Supply Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2000	360.0	0.0	0.0	$0.00	$0.00	$0.00		
5	Emergency Management	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	156.0	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	156.0	0.0	0.0	$0.00	$0.00	$0.00		
201	Emergency Management	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702.0	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2600	324.0	378.0	0.0	$54.92	$0.00	$0.00	0.0	0.0
18	Lunch Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	3102.5	1,389.9	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	3102.5	1,389.9	0.0	0.0	$0.00	$0.00	$0.00		
5	Lunch Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	3102.5	186.2	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	3102.5	186.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Lunch Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	3102.5	347.5	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	3102.5	347.5	0.0	0.0	$0.00	$0.00	$0.00		
18	Constructio Code Official's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	1200	268.8	313.6	0.0	$45.57	$202.50	$35.00	4.4	3.7
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456.0	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	2600	1,456.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456.0	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	2600	1,456.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Building Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	2600	1,747.2	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2600	1,747.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Building Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
208	Building Office	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343.2	2	SP 26 R CF 2	CFQ25/2	66	0.1	None	2600	343.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Planning	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	2600	873.6	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2600	873.6	0.0	0.0	$0.00	$0.00	$0.00		
5	Planning	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	156.0	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	156.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Planning	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291.2	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2600	291.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Planning	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
5	Planning	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Township Planner	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	873.6	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2600	873.6	0.0	0.0	$0.00	$0.00	$0.00		
201	Zoning Officer	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2600	468.0	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Planning Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Finance Directors Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1200	268.8	313.6	0.0	$45.57	$118.75	$20.00	2.6	2.2
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	2600	291.2	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	OCC	1200	134.4	156.8	0.0	$22.78	$118.75	$20.00	5.2	4.3
5	Finance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	312.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	1200	144.0	168.0	0.0	$24.41	$118.75	$20.00	4.9	4.0
18	Finance	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
5	Finance	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	C-OCC	2600	780.0	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	None	2600	780.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291.2	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2600	291.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Finance	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	156.0	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	156.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Engineering Director's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2600	1,747.2	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	1200	806.4	940.8	0.0	$136.70	$118.75	$20.00	0.9	0.7
18	Engineering Reproduction	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,164.8	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	1200	537.6	627.2	0.0	$91.13	$118.75	$20.00	1.3	1.1
18	Township Engineer's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2600	1,747.2	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2600	1,747.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Four Engineering Workstations	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Four Engineering Workstations	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2600	2,912.0	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	None	2600	2,912.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Drafting Computer Area	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Public Works	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,164.8	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	C-OCC	1200	537.6	627.2	0.0	$91.13	$202.50	$35.00	2.2	1.8
18	Recycling Coordination	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	C-OCC	2600	873.6	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2600	873.6	0.0	0.0	$0.00	$0.00	$0.00		
18	Engineer's Secretary	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2600	582.4	0.0	0.0	$0.00	$0.00	$0.00		
201	Fire Official's Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	1,404.0	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	1200	648.0	756.0	0.0	$109.85	$202.50	$35.00	1.8	1.5
201	Rear Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90.0	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	1000	90.0	0.0	0.0	$0.00	$0.00	$0.00		
201	Court Room Closet	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90.0	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	1000	90.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2000	448.0	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2000	448.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Room	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2000	2,240.0	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	None	2000	2,240.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448.0	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2000	448.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896.0	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	2000	896.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896.0	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	2000	896.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038.4	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	2600	2,038.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038.4	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	2600	2,038.4	0.0	0.0	$0.00	$0.00	$0.00		
5	Judge's Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	C-OCC	8760	1,051.2	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	8760	1,051.2	0.0	0.0	$0.00	$0.00	$0.00		

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1b Install Occupancy Sensors

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
5	Judge's Bathroom	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2080	124.8	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	1000	60.0	64.8	0.0	$9.42	$118.75	$20.00	12.6	10.5
201	Court Clerk's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	Breaker	8760	1,576.8	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	1200	216.0	1,360.8	0.0	$197.72	$118.75	$20.00	0.6	0.5
201	Storage Room (Next to Court Clerk)	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1000	360.0	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	None	1000	360.0	0.0	0.0	$0.00	$0.00	$0.00		
204	Water Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	1000	207.0	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	1000	207.0	0.0	0.0	$0.00	$0.00	$0.00		
204	Tax Storage Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	2000	414.0	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	2000	414.0	0.0	0.0	$0.00	$0.00	$0.00		
193	Furnace Room	2	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	1000	144.0	2	W 34 P F 2 (MAG)	F42EE	72	0.1	None	1000	144.0	0.0	0.0	$0.00	$0.00	$0.00		
193	Electric Room & Communications	4	W 34 P F 2 (MAG)	F42EE	72	0.3	SW	1000	288.0	4	W 34 P F 2 (MAG)	F42EE	72	0.3	None	1000	288.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Tax Collector's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582.4	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1200	268.8	313.6	0.0	$45.57	$118.75	$20.00	2.6	2.2
18	Tax Assessor's Office	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	873.6	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	1200	403.2	470.4	0.0	$68.35	$118.75	$20.00	1.7	1.4
18	Utilities Office	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	SW	2600	6,115.2	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	None	2600	6,115.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Utilities Office	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291.2	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2600	291.2	0.0	0.0	$0.00	$0.00	$0.00		
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	2080	187.2	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2080	187.2	0.0	0.0	$0.00	$0.00	$0.00		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	149.8	1	W 34 P F 2 (MAG)	F42EE	72	0.1	None	2080	149.8	0.0	0.0	$0.00	$0.00	$0.00		
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	Breaker	2080	187.2	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2080	187.2	0.0	0.0	$0.00	$0.00	$0.00		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	Breaker	2080	149.8	1	W 34 P F 2 (MAG)	F42EE	72	0.1	None	2080	149.8	0.0	0.0	$0.00	$0.00	$0.00		
201	Women's Bathroom	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2080	561.6	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2080	561.6	0.0	0.0	$0.00	$0.00	$0.00		
5	Tax Department Entrance	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	468.0	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	None	2600	468.0	0.0	0.0	$0.00	$0.00	$0.00		
208	Tax Department Entrance	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343.2	2	SP 26 R CF 2	CFQ25/2	66	0.1	None	2600	343.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Tax Department Entrance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2600	312.0	0.0	0.0	$0.00	$0.00	$0.00		
5	Maintenance Closet	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	1000	120.0	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	1000	120.0	0.0	0.0	$0.00	$0.00	$0.00		
20	Police ESU Supp.	1	S 32 C F 1 (ELE)	F41LL	32	0.0	SW	8760	280.3	1	S 32 C F 1 (ELE)	F41LL	32	0.0	None	8760	280.3	0.0	0.0	$0.00	$0.00	$0.00		
191	Secure Weapons Storage	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	SW	8760	2,155.0	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	None	8760	2,155.0	0.0	0.0	$0.00	$0.00	$0.00		
18	ESU/Comm. Services	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849.0	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8760	7,849.0	0.0	0.0	$0.00	$0.00	$0.00		
18	LT. Offices	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	8760	3,924.5	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8760	3,924.5	0.0	0.0	$0.00	$0.00	$0.00		
18	Captain's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962.2	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582.4	1,379.8	0.0	$200.49	$118.75	$20.00	0.6	0.5
201	Chief's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	8760	1,576.8	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	8760	1,576.8	0.0	0.0	$0.00	$0.00	$0.00		
201	Police Conference Room	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730.4	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	OCC	2600	1,404.0	3,326.4	0.0	$483.33	$118.75	$20.00	0.2	0.2
201	Police Traffic Division	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730.4	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	OCC	2600	1,404.0	3,326.4	0.0	$483.33	$118.75	$20.00	0.2	0.2
208	Dispatch Office	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578.2	1	SP 26 R CF 2	CFQ25/2	66	0.1	None	8760	578.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Dispatch Office	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924.5	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8760	3,924.5	0.0	0.0	$0.00	$0.00	$0.00		
201	Public Bathroom (Police Building)	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	OCC	2080	187.2	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2080	187.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Public Entry	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	Breaker	8760	3,153.6	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	None	8760	3,153.6	0.0	0.0	$0.00	$0.00	$0.00		
201	D.B. Interview	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788.4	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	8760	788.4	0.0	0.0	$0.00	$0.00	$0.00		
201	Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788.4	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	8760	788.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Detectives Division	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	8760	5,886.7	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	8760	5,886.7	0.0	0.0	$0.00	$0.00	$0.00		
18	Detectives Division	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	8760	2,943.4	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	8760	2,943.4	0.0	0.0	$0.00	$0.00	$0.00		
18	Squad Room/Patrol Sgt./Patrol Lt.	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	SW	8760	15,697.9	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	None	8760	15,697.9	0.0	0.0	$0.00	$0.00	$0.00		
191	Secure Storage	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	SW	8760	4,309.9	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	None	8760	4,309.9	0.0	0.0	$0.00	$0.00	$0.00		
18	Records Division	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849.0	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8760	7,849.0	0.0	0.0	$0.00	$0.00	$0.00		
201	Records Storage Division	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365.2	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	8760	2,365.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Patrol Storage	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962.2	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	8760	1,962.2	0.0	0.0	$0.00	$0.00	$0.00		
18	Police Exercise Room	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	8760	7,849.0	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8760	7,849.0	0.0	0.0	$0.00	$0.00	$0.00		
18	Police Women's Locker Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924.5	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8760	3,924.5	0.0	0.0	$0.00	$0.00	$0.00		
18	Police Men's Locker Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981.1	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	8760	981.1	0.0	0.0	$0.00	$0.00	$0.00		
18	Police Men's Locker Room	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	SW	8760	6,867.8	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	8760	6,867.8	0.0	0.0	$0.00	$0.00	$0.00		
208	Police Men's Locker Room	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578.2	1	SP 26 R CF 2	CFQ25/2	66	0.1	None	8760	578.2	0.0	0.0	$0.00	$0.00	$0.00		
47	Cell Block	4	1B 34 C F 3(MAG)	F43EE	115	0.5	Breaker	8760	4,029.6	4	1B 34 C F 3(MAG)	F43EE	115	0.5	None	8760	4,029.6	0.0	0.0	$0.00	$0.00	$0.00		
18	Inmate's Bathroom	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981.1	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	OCC	2600	291.2	689.9	0.0	$100.25	$118.75	$20.00	1.2	1.0
18	Inmate Processing	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	SW	8760	4,905.6	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	8760	4,905.6	0.0	0.0	$0.00	$0.00	$0.00		
18	Inmate Processing	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	8760	981.1	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	8760	981.1	0.0	0.0	$0.00	$0.00	$0.00		
201	Police File Storage	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365.2	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	8760	2,365.2	0.0	0.0	$0.00	$0.00	$0.00		
5	Police Corridors	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	SW	8760	19,972.8	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	None	8760	19,972.8	0.0	0.0	$0.00	$0.00	$0.00		
5	Police Corridors	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	Breaker	8760	5,256.0	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	None	8760	5,256.0	0.0	0.0	$0.00	$0.00	$0.00		
204	Police Drive Thru Sallyport	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	1,813.3	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	8760	1,813.3	0.0	0.0	$0.00	$0.00	$0.00		
	Total	**639**				**69.4**			**330,031**	**639**				**69**				**311,773**	**18,258**	**0**	**2,653**	**$3,471**	**590**		
																		Demand Savings			**0.0**	**$0**			
																		kWh Savings			**18,258**	**$2,653**			
																		Total Savings				**$2,653**		**1.3**	**1.1**

APPENDIX E

ECM-1c Lighting Replacements with Occupancy Sensors

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1c Lighting Replacements with Occupancy Sensors

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
237	Rear Parking Lot Poles	10	WP 400 Po HPS	hps400/1	465	4.7	Breaker	4368	20,311	10	WP 400 Po HPS	hps400/1	465	4.7	None	4,368	20,311	-	-	$ -	$ -	$ -		
237	Police Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,187	6	WP 400 Po HPS	hps400/1	465	2.8	None	4,368	12,187	-	-	$ -	$ -	$ -		
230	Police Loading Sallyport Door	1	WP400MH1	MH400/1	458	0.5	SW	4368	2,001	1	WP400MH1	MH400/1	458	0.5	None	4,368	2,001	-	-	$ -	$ -	$ -		
230	Police Side of Building	3	WP400MH1	MH400/1	458	1.4	SW	4368	6,002	3	WP400MH1	MH400/1	458	1.4	None	4,368	6,002	-	-	$ -	$ -	$ -		
8	Police Entrance Door	1	MH 175	MH175/1	215	0.2	SW	4368	939	1	MH 175	MH175/1	215	0.2	None	4,368	939	-	-	$ -	$ -	$ -		
226	Police Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	None	4,368	830	-	-	$ -	$ -	$ -		
226	Town Hall Sign	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	None	4,368	830	-	-	$ -	$ -	$ -		
226	Flag Pole	3	70 W MH	MH70/1	95	0.3	SW	4368	1,245	3	70 W MH	MH70/1	95	0.3	None	4,368	1,245	-	-	$ -	$ -	$ -		
226	Front Doors	2	70 W MH	MH70/1	95	0.2	SW	4368	830	2	70 W MH	MH70/1	95	0.2	None	4,368	830	-	-	$ -	$ -	$ -		
140	Town Hall Side Exterior Wall	3	WPMH 175	MH175/1	215	0.6	SW	4368	2,817	3	WPMH 175	MH175/1	95	0.6	None	4,368	2,817	-	-	$ -	$ -	$ -		
237	Town Hall Side Entrance Poles	6	WP 400 Po HPS	hps400/1	465	2.8	SW	4368	12,187	6	WP 400 Po HPS	hps400/1	465	2.8	None	4,368	12,187	-	-	$ -	$ -	$ -		
64	Main Public Entrance	2	SP 175 R MH	MH175/1	215	0.4	SW	4368	1,878	2	SP 175 R MH	MH175/1	215	0.4	None	4,368	1,878	-	-	$ -	$ -	$ -		
5	Town Hall Corridors	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	SW	8760	26,280	50	2T 32 R F 2 (u) (ELE)	FU2LL	60	3.0	None	8,760	26,280	-	-	$ -	$ -	$ -		
5	Town Hall Corridors	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	Breaker	8760	9,461	18	2T 32 R F 2 (u) (ELE)	FU2LL	60	1.1	None	8,760	9,461	-	-	$ -	$ -	$ -		
208	Town Hall Corridors	17	SP 26 R CF 2	CFQ25/2	66	1.1	SW	8760	9,829	17	SP 26 R CF 2	CFQ25/2	66	1.1	None	8,760	9,829	-	-	$ -	$ -	$ -		
X1	Town Hall Corridors	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	SW	8760	92	7	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	92	-	-	$ -	$ -	$ -		
X2	Town Hall Corridors	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	SW	8760	26	1	XX 3.0 W CF 2	ELED1.5/2	3	0.0	None	8,760	26	-	-	$ -	$ -	$ -		
204	Town Hall Corridors	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	SW	8760	3,627	2	S 96 P F 2 (MAG) 8'	F82EHE	207	0.4	None	8,760	3,627	-	-	$ -	$ -	$ -		
193	Town Hall Corridors	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	8760	631	1	W 28 P F 2	F42SSILL	112	0.0	None	8,760	420	210	0.0	$ 32.30	$ -	$ -	0.0	0.0
18	Administration Office	9	T 32 R F 4 (ELE)	F44ILL	112	1.0	C-OCC	2600	2,621	9	T 32 R F 4 (ELE)	F44ILL	66	1.0	None	2,600	2,621	-	-	$ -	$ -	$ -		
5	Administration Office	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	C-OCC	2600	468	3	2T 32 R F 2 (u) (ELE)	FU2LL	66	0.2	None	2,600	468	-	-	$ -	$ -	$ -		
18	Administration Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582	2	T 32 R F 4 (ELE)	F44ILL	1.5	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
5	Administration Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	90	0.1	None	2,600	312	-	-	$ -	$ 202.50	$ 35		
5	Clerk's Office	4	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	624	4	2T 32 R F 2 (u) (ELE)	FU2LL	112	0.2	OCC	1,200	288	336	-	$ 48.82	$ -	$ -	0.0	0.0
18	Manager's Office	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	2600	2,330	8	T 32 R F 4 (ELE)	F44ILL	90	0.9	OCC	1,200	1,075	1,254	-	$ 182.26	$ 118.75	$ 20	0.7	0.5
18	Front Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2000	1,344	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	1,000	672	672	-	$ 97.64	$ -	$ -	0.0	0.0
5	Council Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2000	120	1	2T 32 R F 2 (u) (ELE)	FU2LL	112	0.1	None	2,000	120	-	-	$ -	$ 118.75	$ 20		
18	Council Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2000	224	1	T 32 R F 4 (ELE)	F44ILL	90	0.1	None	2,000	224	-	-	$ -	$ -	$ -		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	60	1.7	None	2,000	3,360	-	-	$ -	$ -	$ -		
18	Council Room	18	T 32 R F 4 (ELE)	F44ILL	112	2.0	SW	2000	4,032	18	T 32 R F 4 (ELE)	F44ILL	90	2.0	None	2,000	4,032	-	-	$ -	$ -	$ -		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	None	2,000	3,360	-	-	$ -	$ -	$ -		
18	Council Room	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	SW	2000	3,360	15	T 32 R F 4 (ELE)	F44ILL	112	1.7	None	2,000	3,360	-	-	$ -	$ -	$ -		
208	Council Room	5	SP 26 R CF 2	CFQ25/2	66	0.3	SW	2000	660	5	SP 26 R CF 2	CFQ25/2	66	0.3	None	2,000	660	-	-	$ -	$ -	$ -		
208	Council Room	3	SP 26 R CF 2	CFQ25/2	66	0.2	SW	2000	396	3	SP 26 R CF 2	CFQ25/2	66	0.2	None	2,000	396	-	-	$ -	$ -	$ -		
X1	Council Room Exits	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	8760	26	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	8,760	26	-	-	$ -	$ -	$ -		
201	Admin. File Storage	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	C-OCC	1,000	180	180	-	$ 26.15	$ 202.50	$ 35	7.7	6.4
18	Back Conference Room	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2000	1,344	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2,000	1,344	-	-	$ -	$ -	$ -		
201	Technical Director	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	OCC	1,200	324	378	-	$ 54.92	$ 118.75	$ 20	2.2	1.8
18	Computer Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
18	Court Conference Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1,000	224	224	-	$ 32.55	$ 118.75	$ 20	3.6	3.0
201	Front Supply Room	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	SW	2000	360	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2,000	360	-	-	$ -	$ -	$ -		
5	Emergency Management	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	156	-	-	$ -	$ -	$ -		
201	Emergency Management	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2600	702	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2,600	702	-	-	$ -	$ -	$ -		
18	Lunch Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	3102.5	1,390	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	3,103	1,390	-	-	$ -	$ -	$ -		
5	Lunch Room	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	3102.5	186	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	3,103	186	-	-	$ -	$ -	$ -		
18	Lunch Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	3102.5	347	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	3,103	347	-	-	$ -	$ -	$ -		
18	Constructio Code Official's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	1,200	269	314	-	$ 45.57	$ 202.50	$ 35	4.4	3.7
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	2,600	1,456	-	-	$ -	$ -	$ -		
18	Subcode Officials Office	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	C-OCC	2600	1,456	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	2,600	1,456	-	-	$ -	$ -	$ -		
18	Building Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2,600	1,747	-	-	$ -	$ -	$ -		
5	Building Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	312	-	-	$ -	$ -	$ -		
208	Building Office	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343	2	SP 26 R CF 2	CFQ25/2	66	0.1	None	2,600	343	-	-	$ -	$ -	$ -		
18	Planning	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2,600	874	-	-	$ -	$ -	$ -		
5	Planning	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	156	-	-	$ -	$ -	$ -		
18	Planning	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2,600	291	-	-	$ -	$ -	$ -		
18	Planning	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
5	Planning	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	312	-	-	$ -	$ -	$ -		
18	Township Planner	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2,600	874	-	-	$ -	$ -	$ -		
201	Zoning Officer	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	2600	468	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	2,600	468	-	-	$ -	$ -	$ -		
18	Planning Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
18	Finance Directors Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1,200	269	314	-	$ 45.57	$ 118.75	$ 20	2.6	2.2
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	OCC	1,200	134	157	-	$ 22.78	$ 118.75	$ 20	5.2	4.3
5	Finance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	1,200	144	168	-	$ 24.41	$ 118.75	$ 20	4.9	4.0
18	Finance	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
5	Finance	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	C-OCC	2600	780	5	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.3	None	2,600	780	-	-	$ -	$ -	$ -		
18	Finance	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2,600	291	-	-	$ -	$ -	$ -		
5	Finance	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	156	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	156	-	-	$ -	$ -	$ -		
18	Engineering Director's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	OCC	1,200	806	941	-	$ 136.70	$ 118.75	$ 20	0.9	0.7
18	Engineering Reproduction	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,165	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	1,200	538	627	-	$ 91.13	$ 118.75	$ 20	1.3	1.1
18	Township Engineer's Office	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	C-OCC	2600	1,747	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	2,600	1,747	-	-	$ -	$ -	$ -		
18	Four Engineering Workstations	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
18	Four Engineering Workstations	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2600	2,912	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	None	2,600	2,912	-	-	$ -	$ -	$ -		
18	Drafting Computer Area	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	C-OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
18	Public Works	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2600	1,165	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	C-OCC	1,200	538	627	-	$ 91.13	$ 202.50	$ 35	2.2	1.8
18	Recycling Coordination	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	C-OCC	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	2,600	874	-	-	$ -	$ -	$ -		
18	Engineer's Secretary	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,600	582	-	-	$ -	$ -	$ -		
201	Fire Official's Office	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	2600	1,404	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	C-OCC	1,200	648	756	-	$ 109.85	$ 202.50	$ 35	1.8	1.5
201	Rear Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	1,000	90	-	-	$ -	$ -	$ -		
201	Court Room Closet	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	1000	90	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	1,000	90	-	-	$ -	$ -	$ -		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	Breaker	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,000	448	-	-	$ -	$ -	$ -		
18	Court Room	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	SW	2000	2,240	10	T 32 R F 4 (ELE)	F44ILL	112	1.1	None	2,000	2,240	-	-	$ -	$ -	$ -		
18	Court Room	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2000	448	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	2,000	448	-	-	$ -	$ -	$ -		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	2,000	896	-	-	$ -	$ -	$ -		
18	Court Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	2000	896	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	2,000	896	-	-	$ -	$ -	$ -		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	2,600	2,038	-	-	$ -	$ -	$ -		
18	Court Reception	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	C-OCC	2600	2,038	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	2,600	2,038	-	-	$ -	$ -	$ -		
5	Judge's Office	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	C-OCC	8760	1,051	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	8,760	1,051	-	-	$ -	$ -	$ -		

Energy Audit of Roxbury Township

CHA Project No. 20556 - Town Hall/Police Department

ECM-1c Lighting Replacements with Occupancy Sensors

Cost of Electricity: **$0.145 $/kWh**

$6.08 $/kW

		EXISTING CONDITIONS							RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
5	Judge's Bathroom	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	2080	125	1	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	OCC	1,000	60	65	-	$ 9.42	$ 118.75	$ 20	12.6	10.5
201	Court Clerk's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	Breaker	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	1,200	216	1,361	-	$ 197.72	$ 118.75	$ 20	0.6	0.5
201	Storage Room (Next to Court Clerk)	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	OCC	1000	360	4	T 32 R F 3 (ELE)	F43ILL/2	90	0.4	None	1,000	360	-	-	$ -	$ -	$ -		
204	Water Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	1000	207	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	1,000	207	-	-	$ -	$ -	$ -		
204	Tax Storage Room	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	2000	414	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	2,000	414	-	-	$ -	$ -	$ -		
193	Furnace Room	2	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	1000	144	2	W 28 P F 2	F42SSILL	48	0.1	None	1,000	96	48	0.0	$ 10.48	$ 229.50	$ 20	21.9	20.0
193	Electric Room & Communications	4	W 34 P F 2 (MAG)	F42EE	72	0.3	SW	1000	288	4	W 28 P F 2	F42SSILL	48	0.2	None	1,000	192	96	0.1	$ 20.95	$ 459.00	$ 40	21.9	20.0
18	Tax Collector's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	2600	582	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	1,200	269	314	-	$ 45.57	$ 118.75	$ 20	2.6	2.2
18	Tax Assessor's Office	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	2600	874	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	OCC	1,200	403	470	-	$ 68.35	$ 118.75	$ 20	1.7	1.4
18	Utilities Office	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	SW	2600	6,115	21	T 32 R F 4 (ELE)	F44ILL	112	2.4	None	2,600	6,115	-	-	$ -	$ -	$ -		
18	Utilities Office	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	2600	291	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	2,600	291	-	-	$ -	$ -	$ -		
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2,080	187	-	-	$ -	$ -	$ -		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	150	1	W 28 P F 2	F42SSILL	48	0.0	None	2,080	100	50	0.0	$ 9.00	$ 114.75	$ 10	12.7	11.6
201	Men's Bathroom	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	Breaker	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2,080	187	-	-	$ -	$ -	$ -		
193	Men's Bathroom	1	W 34 P F 2 (MAG)	F42EE	72	0.1	Breaker	2080	150	1	W 28 P F 2	F42SSILL	48	0.0	None	2,080	100	50	0.0	$ 9.00	$ 114.75	$ 10	12.7	11.6
201	Women's Bathroom	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	2080	562	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	2,080	562	-	-	$ -	$ -	$ -		
5	Tax Department Entrance	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	SW	2600	468	3	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.2	None	2,600	468	-	-	$ -	$ -	$ -		
208	Tax Department Entrance	2	SP 26 R CF 2	CFQ25/2	66	0.1	SW	2600	343	2	SP 26 R CF 2	CFQ25/2	66	0.1	None	2,600	343	-	-	$ -	$ -	$ -		
5	Tax Department Entrance	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	Breaker	2600	312	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	2,600	312	-	-	$ -	$ -	$ -		
5	Maintenance Closet	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	SW	1000	120	2	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.1	None	1,000	120	-	-	$ -	$ -	$ -		
20	Police ESU Supp.	1	S 32 C F 1 (ELE)	F41LL	32	0.0	SW	8760	280	1	S 32 C F 1 (ELE)	F41LL	32	0.0	None	8,760	280	-	-	$ -	$ -	$ -		
191	Secure Weapons Storage	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	SW	8760	2,155	2	S 60 P F 2 (ELE) 8'	F82EE	123	0.2	None	8,760	2,155	-	-	$ -	$ -	$ -		
18	ESU/Comm. Services	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8,760	7,849	-	-	$ -	$ -	$ -		
18	LT. Offices	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	OCC	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8,760	3,924	-	-	$ -	$ -	$ -		
18	Captain's Office	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	OCC	2,600	582	1,380	-	$ 200.49	$ 118.75	$ 20	0.6	0.5
201	Chief's Office	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	OCC	8760	1,577	2	T 32 R F 3 (ELE)	F43ILL/2	90	0.2	None	8,760	1,577	-	-	$ -	$ -	$ -		
201	Police Conference Room	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	OCC	2,600	1,404	3,326	-	$ 483.33	$ 118.75	$ 20	0.2	0.2
201	Police Traffic Division	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	SW	8760	4,730	6	T 32 R F 3 (ELE)	F43ILL/2	90	0.5	OCC	2,600	1,404	3,326	-	$ 483.33	$ 118.75	$ 20	0.2	0.2
208	Dispatch Office	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578	1	SP 26 R CF 2	CFQ25/2	66	0.1	None	8,760	578	-	-	$ -	$ -	$ -		
18	Dispatch Office	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8,760	3,924	-	-	$ -	$ -	$ -		
201	Public Bathroom (Police Building)	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	OCC	2080	187	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	2,080	187	-	-	$ -	$ -	$ -		
5	Public Entry	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	Breaker	8760	3,154	6	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.4	None	8,760	3,154	-	-	$ -	$ -	$ -		
201	D.B. Interview	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	8,760	788	-	-	$ -	$ -	$ -		
201	Supply Room	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	SW	8760	788	1	T 32 R F 3 (ELE)	F43ILL/2	90	0.1	None	8,760	788	-	-	$ -	$ -	$ -		
18	Detectives Division	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	SW	8760	5,887	6	T 32 R F 4 (ELE)	F44ILL	112	0.7	None	8,760	5,887	-	-	$ -	$ -	$ -		
18	Detectives Division	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	SW	8760	2,943	3	T 32 R F 4 (ELE)	F44ILL	112	0.3	None	8,760	2,943	-	-	$ -	$ -	$ -		
18	Squad Room/Patrol Sgt./Patrol Lt.	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	SW	8760	15,698	16	T 32 R F 4 (ELE)	F44ILL	112	1.8	None	8,760	15,698	-	-	$ -	$ -	$ -		
191	Secure Storage	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	SW	8760	4,310	4	S 60 P F 2 (ELE) 8'	F82EE	123	0.5	None	8,760	4,310	-	-	$ -	$ -	$ -		
18	Records Division	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	SW	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8,760	7,849	-	-	$ -	$ -	$ -		
201	Records Storage Division	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	8,760	2,365	-	-	$ -	$ -	$ -		
18	Patrol Storage	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	SW	8760	1,962	2	T 32 R F 4 (ELE)	F44ILL	112	0.2	None	8,760	1,962	-	-	$ -	$ -	$ -		
18	Police Exercise Room	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	OCC	8760	7,849	8	T 32 R F 4 (ELE)	F44ILL	112	0.9	None	8,760	7,849	-	-	$ -	$ -	$ -		
18	Police Women's Locker Room	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	SW	8760	3,924	4	T 32 R F 4 (ELE)	F44ILL	112	0.4	None	8,760	3,924	-	-	$ -	$ -	$ -		
18	Police Men's Locker Room	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	8,760	981	-	-	$ -	$ -	$ -		
18	Police Men's Locker Room	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	SW	8760	6,868	7	T 32 R F 4 (ELE)	F44ILL	112	0.8	None	8,760	6,868	-	-	$ -	$ -	$ -		
208	Police Men's Locker Room	1	SP 26 R CF 2	CFQ25/2	66	0.1	SW	8760	578	1	SP 26 R CF 2	CFQ25/2	66	0.1	None	8,760	578	-	-	$ -	$ -	$ -		
47	Cell Block	4	1B 34 C F 3(MAG)	F43EE	115	0.5	Breaker	8760	4,030	4	1B 28 C F 3	F43SSILL	72	0.3	None	8,760	2,523	1,507	0.2	$ 231.48	$ 513.00	$ -	2.2	2.2
18	Inmate's Bathroom	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	SW	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	OCC	2,600	291	690	-	$ 100.25	$ 118.75	$ 20	1.2	1.0
18	Inmate Processing	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	SW	8760	4,906	5	T 32 R F 4 (ELE)	F44ILL	112	0.6	None	8,760	4,906	-	-	$ -	$ -	$ -		
18	Inmate Processing	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	Breaker	8760	981	1	T 32 R F 4 (ELE)	F44ILL	112	0.1	None	8,760	981	-	-	$ -	$ -	$ -		
201	Police File Storage	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	SW	8760	2,365	3	T 32 R F 3 (ELE)	F43ILL/2	90	0.3	None	8,760	2,365	-	-	$ -	$ -	$ -		
5	Police Corridors	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	SW	8760	19,973	38	2T 32 R F 2 (u) (ELE)	FU2LL	60	2.3	None	8,760	19,973	-	-	$ -	$ -	$ -		
5	Police Corridors	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	Breaker	8760	5,256	10	2T 32 R F 2 (u) (ELE)	FU2LL	60	0.6	None	8,760	5,256	-	-	$ -	$ -	$ -		
204	Police Drive Thru Sallyport	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	SW	8760	1,813	1	S 96 P F 2 (MAG) 8'	F82EHE	207	0.2	None	8,760	1,813	-	-	$ -	$ -	$ -		
	Total	**639**				**69.4**			**330,031**	**639**				**69.0**			**310,190**		**0.4**	**2,911**	**4,462**	**595**		
																	Demand Savings			**0.4**	**$28**			
																	kWh Savings			**19,841**	**$2,883**			
																	Total Savings				**$2,911**		**1.5**	**1.3**

APPENDIX F

ECM-2 Door Seals

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Install Door Seals

Existing: Doors or Door Seals result in excessive heat loss and infiltration
Proposed: Install new doors and/or weather-stripping to eliminate door infiltration

Building Footprint	29,520 SF	Ex Occupied Clng Temp.	72 °F	Ex Occupied Htg Temp.	72 °F
Heating System Efficiency	80%	Ex Unoccupied Clng Temp.	72 °F	Ex Unoccupied Htg Temp.	72 °F
Cooling System Efficiency	1.20 kW/ton	Prop Occupied Clng Temp.	72 °F	Prop Occupied Htg Temp.	72 °F
Internal Gains	407,711 btu/h	Prop Unoccupied Clng Temp.	72 °F	Prop Unoccupied Htg Temp.	72 °F
Unocc Internal Gain factor	0.03	Occupied Cooling UA	-19,717 btu/hr/°F	Occupied Heating UA	6,198 btu/hr/°F
Ave Occ Internal Gain Factor	0.7	Unoccupied Cooling UA	-15,754 btu/hr/°F	Unoccupied Heating UA	6,198 btu/hr/°F
		Cooling Occ Enthalpy Set point	27.5 Btu/lb		
		Cooling Unocc Enthalpy Set point	27.5 Btu/lb		

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing 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	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-601,377	-363,849	-285,398	-480,508	-150,009	-12,231	-601,377	-358,717	-285,398	-480,508	-144,877	-12,231	0	0	0	0
97.5	42.5	6	2	4	-502,791	-252,673	-285,398	-401,736	-104,173	-12,231	-502,791	-249,109	-285,398	-401,736	-100,609	-12,231	423	421	0	0
92.5	39.5	45	16	29	-404,204	-202,138	-285,398	-322,965	-83,338	-12,231	-404,204	-199,287	-285,398	-322,965	-80,487	-12,231	2,645	2,632	0	0
87.5	36.6	146	52	94	-305,618	-153,288	-285,398	-244,193	-63,198	-12,231	-305,618	-151,126	-285,398	-244,193	-61,036	-12,231	6,884	6,852	0	0
82.5	34.0	298	106	192	-207,031	-109,492	-285,398	-165,421	-45,142	-12,231	-207,031	-107,947	-285,398	-165,421	-43,597	-12,231	10,679	10,633	0	0
77.5	31.6	476	170	306	-108,445	-69,064	-285,398	-86,649	-28,474	-12,231	-108,445	-68,090	-285,398	-86,649	-27,500	-12,231	11,772	11,725	0	0
72.5	29.2	662	237	426	-9,859	-28,636	-285,398	-7,877	-11,806	-12,231	-9,859	-28,232	-285,398	-7,877	-11,402	-12,231	9,020	8,993	0	0
67.5	27.0	740	264	476	27,892	18,192	-285,398	27,892	7,500	-12,231	27,892	17,936	-285,398	27,892	7,244	-12,231	6,328	6,334	0	0
62.5	24.5	765	273	492	58,883	38,406	-285,398	58,883	15,834	-12,231	58,883	37,865	-285,398	58,883	15,293	-12,231	5,142	5,157	0	0
57.5	21.4	733	262	471	89,874	58,620	-285,398	89,874	24,168	-12,231	89,874	57,793	-285,398	89,874	23,341	-12,231	3,586	3,607	0	0
52.5	18.7	668	239	430	120,864	78,834	-285,398	120,864	32,502	-12,231	120,864	77,722	-285,398	120,864	31,390	-12,231	2,045	2,072	0	0
47.5	16.2	659	235	424	151,855	99,048	-285,398	151,855	40,836	-12,231	151,855	97,651	-285,398	151,855	39,439	-12,231	812	845	0	0
42.5	14.4	685	245	441	182,846	119,262	-285,398	182,846	49,170	-12,231	182,846	117,579	-285,398	182,846	47,487	-12,231	0	0	1,261	1,247
37.5	12.6	739	264	475	213,837	139,475	-285,398	213,837	57,503	-12,231	213,837	137,508	-285,398	213,837	55,536	-12,231	0	0	1,764	1,745
32.5	10.7	717	256	461	244,828	159,689	-285,398	244,828	65,837	-12,231	244,828	157,437	-285,398	244,828	63,585	-12,231	0	0	2,102	2,082
27.5	8.6	543	194	349	275,819	179,903	-285,398	275,819	74,171	-12,231	275,819	177,365	-285,398	275,819	71,633	-12,231	0	0	1,888	1,870
22.5	6.8	318	114	205	306,810	200,117	-285,398	306,810	82,505	-12,231	306,810	197,294	-285,398	306,810	79,682	-12,231	0	0	1,279	1,267
17.5	5.5	245	88	158	337,801	220,331	-285,398	337,801	90,839	-12,231	337,801	217,223	-285,398	337,801	87,731	-12,231	0	0	1,119	1,109
12.5	4.1	156	56	100	368,792	240,544	-285,398	368,792	99,172	-12,231	368,792	237,152	-285,398	368,792	95,780	-12,231	0	0	797	791
7.5	2.6	92	33	59	399,782	260,758	-285,398	399,782	107,506	-12,231	399,782	257,080	-285,398	399,782	103,828	-12,231	0	0	520	516
2.5	1.0	36	13	23	430,773	280,972	-285,398	430,773	115,840	-12,231	430,773	277,009	-285,398	430,773	111,877	-12,231	0	0	223	221
-2.5	0.0	19	7	12	461,764	301,186	-285,398	461,764	124,174	-12,231	461,764	296,938	-285,398	461,764	119,926	-12,231	0	0	128	127
-7.5	-1.5	8	3	5	492,755	321,400	-285,398	492,755	132,508	-12,231	492,755	316,866	-285,398	492,755	127,974	-12,231	0	0	58	58
TOTALS		**8,760**	**3,129**	**5,631**													**59,336**	**59,273**	**11,139**	**11,034**

Existing Building Ventilation & Infiltration	**3,743**	**cfm**
Existing Unocc. Building Ventilation & Infiltration	**1,543**	**cfm**
Door infiltration	**66**	**cfm**
Proposed reduction (80%)	**53**	**cfm**
Proposed Building Ventilation & Infiltration	**3,691**	**cfm**
Proposed Unocc. Building Ventilation & Infiltration	**1,491**	**cfm**

Savings	**105 therms**
	63 kWh

Roxbury Township Town Hall and Police Station Building

CHA Project No. 20556

Building: Town Hall-Police Station

Install Door Seals

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Door Seals (3'x7')	11	ea	$ 35	$ 50	$ -	$ 381	$ 671	$ -	$ 1,052	
Door Seals (double door - 6' x 7')	0	ea	$ 65	$ 100	$ -	$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 1,052		Subtotal
$ 105	10%	Contingency
$ 116	10%	Contractor O&P
$ -	0%	Engineering
$ 1,273		**Total**

APPENDIX G

ECM-3a Window Replacements

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

*Change U-value and air infiltration rates based on new windows or storm windows
See block load spreadsheet for U-values

Replace Windows

Description Windows can lead to increased energy consumption due to infiltration/infiltration and heat gain/loss. Replacing older windows with more panes and low-emissivity coatings and insulated frames can decrease energy usage.

	Occupied Cooling Hours per Week	60	Hours		
	Occupied Heating Hours per Week	60	Hours		
Given	Heating Energy Cost	$1.50	$/therm		
	Cooling Cost	$0.161	$/kWh		
	Occupied Cooling Setpoint Temperature	72.0	Degrees F		(Assumption)
	Occupied Cooling Avg Space Air Enthalpy	25.5	btu/# air		(Assumption)
	Occupied Heating Setpoint Temperature	72.0	Degrees F	Occupied	(Assumption)
	Unoccupied Heating Setpoint Temperature	72.0	Degrees F	Unoccupied	(Assumption)
	Window Area	1,808	sq.ft.		(From window survey)
	Window Perimeter	1,764	ft		(From window survey)
	Proposed U factor	0.50	Btu/(h*sq.ft*degf)		(From window vendor)
	Proposed Air Infiltration	0.20	cfm/ft		(From window vendor)
	Cooling Conversion	12,000	Btu/ton		
	Heating Btu Conversion	1,000,000	Btu/MMBtu		
Assumptions	Existing U factor	0.90	Btu/(h*sq.ft*degf)		(From ASHRAE Fundamentals)
	Existing Air Infiltration	0.30	cfm/ft		(From ASHRAE Fundamentals)
	Heating System Efficiency	80%			
	Cooling System Efficiency	1.20	kW/ton		

Formula Cooling Energy Conduction = (Existing U x Area x (OA Temp - RA Temp) x Op Hours)

Heating Energy Conduction = (Existing U x Area x (RA Temp - OA Temp) x Op Hours)
Cooling Energy Infiltration = (4.5 x Leakage x Perimeter x (OA Enthalpy - RA Enthalpy) x Op Hours)
Heating Energy Infiltration = 1.08 x Leakage x Perimeter x (RA temp - OA temp) x Op Hours)
Load = (Conduction) + (Infiltration)
Cooling Energy = (Cooling Load) / (12,000 Btu/Ton) x (kw/Ton)
Heating Energy = (Heating Load) / (1,000,000 Btu/MMBtu) / (Boiler Efficiency)
Energy Cost = (Energy) x (Cost/Unit)

Existing	Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
	Cooling	38.3	92.5	51	18.2	0.0	0.0	607,862	0	0	555,460	0	0
	Cooling	36.6	87.5	146	52.2	0.0	0.0	1,315,727	0	0	1,378,950	0	0
	Cooling	33.5	82.5	298	106.5	0.0	0.0	1,819,227	0	0	2,028,518	0	0
	Cooling	31.6	77.5	476	170.1	0.0	0.0	1,522,127	0	0	2,470,640	0	0
	Cooling	30.3	72.5	662	236.5	0.0	0.0	192,446	0	0	2,703,783	0	0
	Heating	27.9	67.5	740	0.0	264.4	475.9	0	1,936,090	3,484,962	0	680,030	1,224,054
	Heating	24.6	62.5	765	0.0	273.3	492.0	0	4,225,385	7,605,693	0	1,484,120	2,671,416
	Heating	21.6	57.5	733	0.0	261.9	471.4	0	6,179,499	11,123,097	0	2,170,481	3,906,865
	Heating	18.7	52.5	668	0.0	238.7	429.6	0	7,573,425	13,632,165	0	2,660,082	4,788,147
	Heating	16.2	47.5	659	0.0	235.5	423.8	0	9,387,128	16,896,831	0	3,297,125	5,934,825
	Heating	14.3	42.5	685	0.0	244.8	440.6	0	11,748,809	21,147,856	0	4,126,639	7,427,951
	Heating	12.4	37.5	739	0.0	264.0	475.3	0	14,823,296	26,681,933	0	5,206,519	9,371,734
	Heating	10.4	32.5	717	0.0	256.2	461.1	0	16,466,356	29,639,441	0	5,783,626	10,410,526
	Heating	8.7	27.5	543	0.0	194.0	349.2	0	14,048,860	25,287,949	0	4,934,507	8,882,112
	Heating	7	22.5	318	0.0	113.6	204.5	0	9,151,949	16,473,508	0	3,214,521	5,786,137
	Heating	5.4	17.5	245	0.0	87.5	157.6	0	7,763,255	13,973,859	0	2,726,757	4,908,163
	Heating	3.9	12.5	156	0.0	55.7	100.3	0	5,396,632	9,713,938	0	1,895,507	3,411,913
	Heating	2.5	7.5	92	0.0	32.9	59.2	0	3,450,077	6,210,139	0	1,211,801	2,181,243
	Heating	1.2	2.5	36	0.0	12.9	23.2	0	1,454,684	2,618,431	0	510,942	919,695
	Heating	-0.2	-2.5	19	0.0	6.8	12.2	0	822,984	1,481,370	0	289,064	520,315
	Heating	-1.4	-7.5	8	0.0	2.9	5.1	0	369,607	665,292	0	129,820	233,677
	Subtotal =			**8,760**	**583**	**2,545**	**4,581**	**5,457,389**	**114,798,036**	**206,636,465 btu**	**9,137,352**	**40,321,540**	**72,578,772 btu**

	Conduction	Infiltration		
Cooling Load =	(5457389) + (	9137352) =		**14,594,741 btu**
	Cooling Load			
Cooling Energy =	(14594741)/(	12000) * (	1.20) =	**1459 kWh**
	Cooling Energy	Cooling Cost		
Cooling Energy Cost =	(1459.47) x (	$0.161) =		**$ 235.18**
	Conduction	Infiltration		
Heating Load =	(321434500) + (	112900313) =		**434,334,813 btu**
	Heating Load	Heat Content		
Heating Energy =	(434334813)/(	80%)/(	100000) =	**5,429 therms**
	Heating Energy	Heating Cost		
Heating Energy Cost =	(5429.19) x (	$1.496) =		**$ 8,122**

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

*Change U-value and air infiltration rates based on new windows or storm windows
See block load spreadsheet for U-values

Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	51	18.2	0.0	0.0	337,701	0	0	370,307	0	0
Cooling	36.6	87.5	146	52.2	0.0	0.0	730,959	0	0	919,300	0	0
Cooling	33.5	82.5	298	106.5	0.0	0.0	1,010,681	0	0	1,352,346	0	0
Cooling	31.6	77.5	476	170.1	0.0	0.0	845,626	0	0	1,647,093	0	0
Cooling	30.3	72.5	662	236.5	0.0	0.0	106,915	0	0	1,802,522	0	0
Heating	27.9	67.5	740	0.0	264.4	475.9	0	1,075,605	1,936,090	0	453,353	816,036
Heating	24.6	62.5	765	0.0	273.3	492.0	0	2,347,436	4,225,385	0	989,413	1,780,944
Heating	21.6	57.5	733	0.0	261.9	471.4	0	3,433,055	6,179,499	0	1,446,987	2,604,577
Heating	18.7	52.5	668	0.0	238.7	429.6	0	4,207,458	7,573,425	0	1,773,388	3,192,098
Heating	16.2	47.5	659	0.0	235.5	423.8	0	5,215,071	9,387,128	0	2,198,083	3,956,550
Heating	14.3	42.5	685	0.0	244.8	440.6	0	6,527,116	11,748,809	0	2,751,093	4,951,967
Heating	12.4	37.5	739	0.0	264.0	475.3	0	8,235,165	14,823,296	0	3,471,013	6,247,823
Heating	10.4	32.5	717	0.0	256.2	461.1	0	9,147,976	16,466,356	0	3,855,750	6,940,351
Heating	8.7	27.5	543	0.0	194.0	349.2	0	7,804,922	14,048,860	0	3,289,671	5,921,408
Heating	7	22.5	318	0.0	113.6	204.5	0	5,084,416	9,151,949	0	2,143,014	3,857,425
Heating	5.4	17.5	245	0.0	87.5	157.6	0	4,312,919	7,763,255	0	1,817,838	3,272,109
Heating	3.9	12.5	156	0.0	55.7	100.3	0	2,998,129	5,396,632	0	1,263,672	2,274,609
Heating	2.5	7.5	92	0.0	32.9	59.2	0	1,916,709	3,450,077	0	807,868	1,454,162
Heating	1.2	2.5	36	0.0	12.9	23.2	0	808,158	1,454,684	0	340,628	613,130
Heating	-0.2	-2.5	19	0.0	6.8	12.2	0	457,213	822,984	0	192,709	346,877
Heating	-1.4	-7.5	8	0.0	2.9	5.1	0	205,337	369,607	0	86,547	155,784
Subtotal =			**8,760**	**583**	**2,545**	**4,581**	**3,031,883**	**63,776,687**	**114,798,036**	**6,091,568**	**26,881,027**	**48,385,848**

btu

	Conduction	Infiltration		
Cooling Load =	(3031883) + (	6091568) =	**9,123,451**	**btu**
	Cooling Load			
Cooling Energy =	(9123451)/(	12000) * (1.20) =	**912**	**kWh**
	Cooling Energy	Cooling Cost		
Cooling Energy Cost =	(912.35) x (	$0.161) =	**$ 147.01**	
	Conduction	Infiltration		
Heating Load =	(178574722) + (	75266875) =	**253,841,597**	**btu**
	Heating Load	Heat Content		
Heating Energy =	(253841597)/(	80%) / (100000) =	**3173**	**therms**
	Heating Energy	Heating Cost		
Heating Energy Cost =	(3173.02) x (	$1.496) =	**$ 4,747**	

Summary

EXISTING COOLING ENERGY	**1459.47**	**kWh**	**$**	**235.18**
EXISTING HEATING ENERGY	**5429.19**	**therms**	**$**	**8,121.78**
EXISTING ENERGY COST			**$**	**8,356.96**

PROPOSED COOLING ENERGY	**912.35**	**kWh**	**$**	**147.01**
PROPOSED HEATING ENERGY	**3173.02**	**therms**	**$**	**4,746.67**
PROPOSED ENERGY COST			**$**	**4,893.69**

COOLING ENERGY SAVINGS	**547.13**	**kWh**	**$**	**88.16**	**37.5% of existing**
COOLING ENERGY SAVINGS	0.183847119	**kWh**	**$**	**13.41**	
HEATING ENERGY SAVINGS	**2256.17**	**therms**	**$**	**3,375.10**	**41.6% of existing**
ENERGY COST SAVINGS			**$**	**3,463.27**	**41.4% of existing**

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Replace Windows

Multipliers	
Material:	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Replace Existing Window Units	76	ea.			$ 495	$ -	$ -	$ 41,006	$ 41,006	
Remove Existing Window Units	76	ea.			$ 50	$ -	$ -	$ 4,142	$ 4,142	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 45,148	Subtotal
$ 6,772	15% Contingency
$ 7,788	Contractor 15% O&P
$ 5,971	10% Engineering
$ 65,679	**Total**

APPENDIX H

ECM-3b Replace Window Seals

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Replace Window Seals

Existing: Window Seals result in excessive heat loss and infiltration
Proposed: Install window weatherstripping to reduce infiltration

Building Footprint	29,520 SF	Ex Occupied Clng Temp.	72 °F	Ex Occupied Htg Temp.	72 °F
Heating System Efficiency	80%	Ex Unoccupied Clng Temp.	72 °F	Ex Unoccupied Htg Temp.	72 °F
Cooling System Efficiency	1.20 kW/ton	Prop Occupied Clng Temp.	72 °F	Prop Occupied Htg Temp.	72 °F
Internal Gains	407,711 btu/h	Prop Unoccupied Clng Temp.	72 °F	Prop Unoccupied Htg Temp.	72 °F
Unoc Internal Gain factor	0.03	Occupied Cooling UA	-19,717 btu/hr/°F	Occupied Heating UA	6,198 btu/hr/°F
Ave Occ Internal Gain Factor	0.7	Unoccupied Cooling UA	-15,754 btu/hr/°F	Unoccupied Heating UA	6,198 btu/hr/°F
		Cooling Occ Enthalpy Setpoint	27.5 Btu/lb		
		Cooling Unocc Enthalpy Setpoint	27.5 Btu/lb		

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing 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	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-601,377	-363,849	-285,398	-480,508	-150,009	-12,231	-601,377	-322,698	-285,398	-480,508	-108,858	-12,231	0	0	0	0
97.5	42.5	6	2	4	-502,791	-252,673	-285,398	-401,736	-104,173	-12,231	-502,791	-224,096	-285,398	-401,736	-75,596	-12,231	423	406	0	0
92.5	39.5	45	16	29	-404,204	-202,138	-285,398	-322,965	-83,338	-12,231	-404,204	-179,277	-285,398	-322,965	-60,477	-12,231	2,645	2,542	0	0
87.5	36.6	146	52	94	-305,618	-153,288	-285,398	-244,193	-63,198	-12,231	-305,618	-135,952	-285,398	-244,193	-45,862	-12,231	6,884	6,631	0	0
82.5	34.0	298	106	192	-207,031	-109,492	-285,398	-165,421	-45,142	-12,231	-207,031	-97,108	-285,398	-165,421	-32,758	-12,231	10,679	10,310	0	0
77.5	31.6	476	170	306	-108,445	-69,064	-285,398	-86,649	-28,474	-12,231	-108,445	-61,253	-285,398	-86,649	-20,663	-12,231	11,772	11,400	0	0
72.5	29.2	662	237	426	-9,859	-28,636	-285,398	-7,877	-11,806	-12,231	-9,859	-25,398	-285,398	-7,877	-8,568	-12,231	9,020	8,806	0	0
67.5	27.0	740	264	476	27,892	18,192	-285,398	27,892	7,500	-12,231	27,892	16,135	-285,398	27,892	5,443	-12,231	6,328	6,382	0	0
62.5	24.5	765	273	492	58,883	38,406	-285,398	58,883	15,834	-12,231	58,883	34,063	-285,398	58,883	11,491	-12,231	5,142	5,260	0	0
57.5	21.4	733	262	471	89,874	58,620	-285,398	89,874	24,168	-12,231	89,874	51,990	-285,398	89,874	17,538	-12,231	3,586	3,759	0	0
52.5	18.7	668	239	430	120,864	78,834	-285,398	120,864	32,502	-12,231	120,864	69,918	-285,398	120,864	23,586	-12,231	2,045	2,258	0	0
47.5	16.2	659	235	424	151,855	99,048	-285,398	151,855	40,836	-12,231	151,855	87,846	-285,398	151,855	29,634	-12,231	812	1,076	0	0
42.5	14.4	685	245	441	182,846	119,262	-285,398	182,846	49,170	-12,231	182,846	105,773	-285,398	182,846	35,681	-12,231	0	0	1,261	1,146
37.5	12.6	739	264	475	213,837	139,475	-285,398	213,837	57,503	-12,231	213,837	123,701	-285,398	213,837	41,729	-12,231	0	0	1,764	1,618
32.5	10.7	717	256	461	244,828	159,689	-285,398	244,828	65,837	-12,231	244,828	141,629	-285,398	244,828	47,777	-12,231	0	0	2,102	1,940
27.5	8.6	543	194	349	275,819	179,903	-285,398	275,819	74,171	-12,231	275,819	159,556	-285,398	275,819	53,824	-12,231	0	0	1,888	1,749
22.5	6.8	318	114	205	306,810	200,117	-285,398	306,810	82,505	-12,231	306,810	177,484	-285,398	306,810	59,872	-12,231	0	0	1,279	1,189
17.5	5.5	245	88	158	337,801	220,331	-285,398	337,801	90,839	-12,231	337,801	195,412	-285,398	337,801	65,920	-12,231	0	0	1,119	1,042
12.5	4.1	156	56	100	368,792	240,544	-285,398	368,792	99,172	-12,231	368,792	213,339	-285,398	368,792	71,967	-12,231	0	0	797	744
7.5	2.6	92	33	59	399,782	260,758	-285,398	399,782	107,506	-12,231	399,782	231,267	-285,398	399,782	78,015	-12,231	0	0	520	486
2.5	1.0	36	13	23	430,773	280,972	-285,398	430,773	115,840	-12,231	430,773	249,195	-285,398	430,773	84,063	-12,231	0	0	223	209
-2.5	0.0	19	7	12	461,764	301,186	-285,398	461,764	124,174	-12,231	461,764	267,122	-285,398	461,764	90,110	-12,231	0	0	128	120
-7.5	-1.5	8	3	5	492,755	321,400	-285,398	492,755	132,508	-12,231	492,755	285,050	-285,398	492,755	96,158	-12,231	0	0	58	55
TOTALS		**8,760**	**3,129**	**5,631**													**59,336**	**58,830**	**11,139**	**10,298**

Existing Building Ventilation & Infiltration	**3,743**	**cfm**
Existing Unocc. Building Ventilation & Infiltration	**1,543**	**cfm**
Window infiltration	**529**	**cfm**
Proposed reduction (80%)	**423**	**cfm**
Proposed Building Ventilation & Infiltration	**3,320**	**cfm**
Proposed Unocc. Building Ventilation & Infiltration	**1,120**	**cfm**

Savings	**841 therms**
	506 kWh
	0.2 kW

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Replace Window Seals

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
Window Seals (3'x7')	76	ea	$ 35	$ 50	$ -	$ 2,633	$ 4,636	$ -	$ 7,269	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 7,269		Subtotal
$ 727	10%	Contingency
$ 800	10%	Contractor O&P
$ -	0%	Engineering
$ 8,796		**Total**

APPENDIX I

ECM-4a Night Setback Controls

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Night Setback Controls

Building Footprint	29,520	SF	Ex Occupied Clng Temp.	72	*F	Ex Occupied Htg Temp.	72	*F	**Heating Energy Savings**	**2,128**	**therms**
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	72	*F	Ex Unoccupied Htg Temp.	72	*F	**Cooling Energy Savings**	**5,310**	**kWh**
Cooling Efficiency	1.2	kW/ton	Prop Occupied Clng Temp.	72	*F	Prop Occupied Htg Temp.	72	*F			
Building Balance Temp.	60	*F	Prop Unoccupied Clng Temp.	80	*F	Prop Unoccupied Htg Temp.	60	*F	Building Footprint	29,520	SF
Internal Gains	407,711	btu/h	Occupied Cooling UA	-19,717	btu/hr/°F	Occupied Heating UA	6,198	btu/hr/°F	Police Station 24/7	7930	SF
Unoc Internal Gain factor	0.03		Unoccupied Cooling UA	-11,522	btu/hr/°F	Unoccupied Heating UA	4,533	btu/hr/°F	Percentage to Night Setback	73%	
Ave Occ Internal Gain Factor	0.7		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb						
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb						

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing 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	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-601,377	-363,849	-285,398	-351,429	-150,009	-12,231	-601,377	-363,849	-285,398	-259,251	-150,009	-12,231	0	0	0	0
97.5	42.5	6	2	4	-502,791	-252,673	-285,398	-293,817	-104,173	-12,231	-502,791	-252,673	-285,398	-201,639	-104,173	-12,231	381	346	0	0
92.5	39.5	45	16	29	-404,204	-202,138	-285,398	-236,206	-83,338	-12,231	-404,204	-202,138	-285,398	-144,028	-83,338	-12,231	2,394	2,127	0	0
87.5	36.6	146	52	94	-305,618	-153,288	-285,398	-178,595	-63,198	-12,231	-305,618	-153,288	-285,398	-86,417	-63,198	-12,231	6,268	5,403	0	0
82.5	34	298	106	192	-207,031	-109,492	-285,398	-120,984	-45,142	-12,231	-207,031	-109,492	-285,398	-28,806	-45,142	-12,231	9,827	8,061	0	0
77.5	31.6	476	170	306	-108,445	-69,064	-285,398	-63,372	-28,474	-12,231	-108,445	-69,064	-285,398	0	0	-12,231	11,059	8,247	0	0
72.5	29.2	662	237	426	-9,859	-28,636	-285,398	-5,761	-11,806	-12,231	-9,859	-28,636	-285,398	0	0	-12,231	8,930	8,182	0	0
67.5	27	740	264	476	27,892	18,192	-285,398	20,399	7,500	-12,231	27,892	18,192	-285,398	0	0	-12,231	6,328	6,910	0	0
62.5	24.5	765	273	492	58,883	38,406	-285,398	43,065	15,834	-12,231	58,883	38,406	-285,398	0	0	-12,231	5,142	5,744	0	0
57.5	21.4	733	262	471	89,874	58,620	-285,398	65,731	24,168	-12,231	89,874	58,620	-285,398	11,333	4,167	-12,231	3,586	3,586	0	0
52.5	18.7	668	239	430	120,864	78,834	-285,398	88,396	32,502	-12,231	120,864	78,834	-285,398	33,999	12,501	-12,231	2,045	2,045	0	0
47.5	16.2	659	235	424	151,855	99,048	-285,398	111,062	40,836	-12,231	151,855	99,048	-285,398	56,664	20,835	-12,231	812	812	0	0
42.5	14.4	685	245	441	182,846	119,262	-285,398	133,728	49,170	-12,231	182,846	119,262	-285,398	79,330	29,168	-12,231	0	0	991	581
37.5	12.6	739	264	475	213,837	139,475	-285,398	156,394	57,503	-12,231	213,837	139,475	-285,398	101,996	37,502	-12,231	0	0	1,422	980
32.5	10.7	717	256	461	244,828	159,689	-285,398	179,060	65,837	-12,231	244,828	159,689	-285,398	124,662	45,836	-12,231	0	0	1,723	1,294
27.5	8.6	543	194	349	275,819	179,903	-285,398	201,725	74,171	-12,231	275,819	179,903	-285,398	147,327	54,170	-12,231	0	0	1,564	1,239
22.5	6.8	318	114	205	306,810	200,117	-285,398	224,391	82,505	-12,231	306,810	200,117	-285,398	169,993	62,504	-12,231	0	0	1,068	878
17.5	5.5	245	88	158	337,801	220,331	-285,398	247,057	90,839	-12,231	337,801	220,331	-285,398	192,659	70,837	-12,231	0	0	940	793
12.5	4.1	156	56	100	368,792	240,544	-285,398	269,723	99,172	-12,231	368,792	240,544	-285,398	215,325	79,171	-12,231	0	0	673	580
7.5	2.6	92	33	59	399,782	260,758	-285,398	292,388	107,506	-12,231	399,782	260,758	-285,398	237,990	87,505	-12,231	0	0	441	386
2.5	1	36	13	23	430,773	280,972	-285,398	315,054	115,840	-12,231	430,773	280,972	-285,398	260,656	95,839	-12,231	0	0	190	168
-2.5	0	19	7	12	461,764	301,186	-285,398	337,720	124,174	-12,231	461,764	301,186	-285,398	283,322	104,173	-12,231	0	0	109	98
-7.5	-1.5	8	3	5	492,755	321,400	-285,398	360,386	132,508	-12,231	492,755	321,400	-285,398	305,988	112,507	-12,231	0	0	50	45
TOTALS		**8,760**	**3,129**	**5,631**													**56,773**	**51,462**	**9,170**	**7,042**

Existing Building Ventilation & Infiltration (occ)	**3,743**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**1,543**	**cfm**

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Night Setback Controls

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	Means Mechanical-2009
Host Computer Complete	1	ea				$ -	$ -	$ -	$ 8,512	
Computer Start up and Checkout labor	3	ea		$ 90		$ -	$ 329	$ -	$ 329	
Programmable Thermostats	10	ea	$ -	$ -	$ 577	$ -	$ -	$ 6,289	$ 6,289	
Outside air Temperature Sensor	1	ea	$ -	$ -		$ -	$ -	$ -	$ -	
Enthalpy Sensor	0	ea	$ -	$ -	$ 927	$ -	$ -	$ -	$ -	
Police Exhaust Fan Relay	0	ea	$ 97	$ 90		$ -	$ -	$ -	$ -	
Police Exhaust Fan Occupancy Sensor	0	ea	$ -	$ -	$ 577	$ -	$ -	$ -	$ -	
Split AC Units	2	ea	$ 97	$ 90		$ 192	$ 220	$ -	$ 412	
Programming Points						$ -	$ -	$ -	$ -	
10 Thermostats, 10 Dampers, 5 Roof Top Unit, 1 Fan Relay, 2 Split AC Units, 1 Proposed Condensing Boiler, 1 Outside Air Tempearture	13	ea point	$ -	$ 90		$ -	$ 1,427	$ -	$ 1,427	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 16,970	Subtotal
$ 1,696.98	10% Contingency
$ 2,800.01	15% Contractor O&P
$ 2,147	10% Engineering
$ 23,613	**Total**

APPENDIX J

ECM-4b Night Shutdown

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Building Footprint 29,520 SF
Police Station 24/7 7930 SF
Percentage to Night Setback 73%

Night Shutdown

											Existing
Building Footprint	29,520	SF	Ex Occupied Clng Temp.	72	°F	Ex Occupied Htg Temp.	72	°F	Exhaust Fan Motor Power	0.2	kW
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	80	°F	Ex Unoccupied Htg Temp.	60	°F	Supply/Return Fan Motor Power	2.9	kW
Cooling Efficiency	1.2	kW/ton	Prop Occupied Clng Temp.	72	°F	Prop Occupied Htg Temp.	72	°F	Existing unoccupied ventilation/infiltration CFM	3,743	cfm
Internal Gains	407,711	btu/h	Prop Unoccupied Clng Temp.	80	°F	Prop Unoccupied Htg Temp.	60	°F	Proposed unoccupied ventilation/infiltration CFM	1,543	cfm
Unoc Internal Gain factor	0.03		Occupied Cooling UA	-19,717	btu/hr/°F	Occupied Heating UA	6,198	btu/hr/°F	**Fan Energy Savings**	**12,591**	**kWh**
Ave Occ Internal Gain Factor	0.7		Unoccupied Cooling UA	-15,754	btu/hr/°F	Unoccupied Heating UA	6,198	btu/hr/°F	**Heating Energy Savings**	**0**	**therms**
			Cooling Occ Enthalpy Setpoint	27.5	Btu/lb				**Cooling Energy Savings**	**0**	**kWh**
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb						

					EXISTING LOADS						PROPOSED LOADS											
					Occupied			Unoccupied			Occupied			Unoccupied								
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms	Existing Fan Energy kWh	Proposed Fan Energy kWh
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N	O	P
102.5	49.1	0	0	0	-601,377	-363,849	-285,398	-354,473	-150,009	-12,231	-601,377	-363,849	-285,398	-354,473	-150,009	-12,231	0	0	0	0	0	0
97.5	42.5	6	2	4	-502,791	-252,673	-285,398	-275,701	-104,173	-12,231	-502,791	-252,673	-285,398	-275,701	-104,173	-12,231	374	374	0	0	19	12
92.5	39.5	45	16	29	-404,204	-202,138	-285,398	-196,930	-83,338	-12,231	-404,204	-202,138	-285,398	-196,930	-83,338	-12,231	2,280	2,280	0	0	140	89
87.5	36.6	146	52	94	-305,618	-153,288	-285,398	-118,158	-63,198	-12,231	-305,618	-153,288	-285,398	-118,158	-63,198	-12,231	5,701	5,701	0	0	453	269
82.5	34.0	298	106	192	-207,031	-109,492	-285,398	-39,386	-45,142	-12,231	-207,031	-109,492	-285,398	-39,386	-45,142	-12,231	8,264	8,264	0	0	924	479
77.5	31.6	476	170	306	-108,445	-69,064	-285,398	0	0	-12,231	-108,445	-69,064	-285,398	0	0	-12,231	8,247	8,247	0	0	1,476	527
72.5	29.2	662	237	426	-9,859	-28,636	-285,398	0	0	-12,231	-9,859	-28,636	-285,398	0	0	-12,231	8,182	8,182	0	0	2,053	733
67.5	27.0	740	264	476	27,892	18,192	-285,398	0	0	-12,231	27,892	18,192	-285,398	0	0	-12,231	6,910	6,910	0	0	2,295	820
62.5	24.5	765	273	492	58,883	38,406	-285,398	0	0	-12,231	58,883	38,406	-285,398	0	0	-12,231	5,744	5,744	0	0	2,373	847
57.5	21.4	733	262	471	89,874	58,620	-285,398	15,495	4,167	-12,231	89,874	58,620	-285,398	15,495	4,167	-12,231	3,586	3,586	0	0	2,273	993
52.5	18.7	668	239	430	120,864	78,834	-285,398	46,486	12,501	-12,231	120,864	78,834	-285,398	46,486	12,501	-12,231	2,045	2,045	0	0	2,072	1,108
47.5	16.2	659	235	424	151,855	99,048	-285,398	77,477	20,835	-12,231	151,855	99,048	-285,398	77,477	20,835	-12,231	812	812	0	0	2,044	1,212
42.5	14.4	685	245	441	182,846	119,262	-285,398	108,468	29,168	-12,231	182,846	119,262	-285,398	108,468	29,168	-12,231	0	0	742	742	2,124	1,341
37.5	12.6	739	264	475	213,837	139,475	-285,398	139,459	37,502	-12,231	213,837	139,475	-285,398	139,459	37,502	-12,231	0	0	1,203	1,203	2,292	1,509
32.5	10.7	717	256	461	244,828	159,689	-285,398	170,450	45,836	-12,231	244,828	159,689	-285,398	170,450	45,836	-12,231	0	0	1,558	1,558	2,224	1,509
27.5	8.6	543	194	349	275,819	179,903	-285,398	201,441	54,170	-12,231	275,819	179,903	-285,398	201,441	54,170	-12,231	0	0	1,476	1,476	1,684	1,170
22.5	6.8	318	114	205	306,810	200,117	-285,398	232,432	62,504	-12,231	306,810	200,117	-285,398	232,432	62,504	-12,231	0	0	1,037	1,037	986	697
17.5	5.5	245	88	158	337,801	220,331	-285,398	263,423	70,837	-12,231	337,801	220,331	-285,398	263,423	70,837	-12,231	0	0	933	933	760	545
12.5	4.1	156	56	100	368,792	240,544	-285,398	294,413	79,171	-12,231	368,792	240,544	-285,398	294,413	79,171	-12,231	0	0	679	679	484	351
7.5	2.6	92	33	59	399,782	260,758	-285,398	325,404	87,505	-12,231	399,782	260,758	-285,398	325,404	87,505	-12,231	0	0	450	450	285	209
2.5	1.0	36	13	23	430,773	280,972	-285,398	356,395	95,839	-12,231	430,773	280,972	-285,398	356,395	95,839	-12,231	0	0	196	196	112	83
-2.5	0.0	19	7	12	461,764	301,186	-285,398	387,386	104,173	-12,231	461,764	301,186	-285,398	387,386	104,173	-12,231	0	0	114	114	59	44
-7.5	-1.5	8	3	5	492,755	321,400	-285,398	418,377	112,507	-12,231	492,755	321,400	-285,398	418,377	112,507	-12,231	0	0	52	52	25	19
TOTALS		**8,760**	**3,129**	**5,631**													**52,145**	**52,145**	**8,439**	**8,439**	**27,156**	**14,565**

Existing Building Ventilation & Infiltration (occ) **3,743 cfm**
Overheat Ventilation Factor **1.00**
Additional ventilation to offset overheat **0 cfm**
Existing Building Ventilation & Infiltration (unocc) **1,543 cfm**

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Night Shutdown

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	Means Mechanical-2009
Host Computer Complete	1	ea				$ -	$ -	$ -	$ 8,512	
Computer Start up and Checkout labor	3	ea		$ 90		$ -	$ 329	$ -	$ 329	
Programmable Thermostats	0	ea	$ -	$ -	$ 577	$ -	$ -	$ -	$ -	
Outside air Temperature Sensor	1	ea	$ -	$ -		$ -	$ -	$ -	$ -	
Enthalpy Sensor	0	ea	$ -	$ -	$ 927	$ -	$ -	$ -	$ -	
Police Exhaust Fan Relay	1	ea	$ 97	$ 90		$ 96	$ 110	$ -	$ 206	
Police Exhaust Fan Occupancy Sensor	1	ea	$ -	$ -	$ 577	$ -	$ -	$ 629	$ 629	
Split AC Units	2	ea	$ 97	$ 90		$ 192	$ 220	$ -	$ 412	
Programming Points						$ -	$ -	$ -	$ -	
1 Fan Relay, 2 Split AC Units, 1 Outside Air Tempearture Sensor	5	ea point	$ -	$ 90		$ -	$ 549	$ -	$ 549	
						$ -	$ -	$ -	$ -	

$ 10,637	Subtotal
$ 1,063.68	10% Contingency
$ 1,755.08	15% Contractor O&P
$ 1,346	10% Engineering
$ 14,801	**Total**

APPENDIX K

ECM-4c Enthalpy Economizer

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station
Enthalpy Economizer

Building Footprint	29,520 SF	Ex Occupied Clng Temp.	72 *F	Ex Occupied Htg Temp.	72 *F		
Heating Efficiency	80%	Ex Unoccupied Clng Temp.	72 *F	Ex Unoccupied Htg Temp.	72 *F		
Cooling Efficiency	1.20 kW/ton	Occupied Cooling UA	(19,717) btu/hr/°F	Occupied Heating UA	6,198 btu/hr/°F		
Internal Gains	407,711 btu/h	Unoccupied Cooling UA	(15,754) btu/hr/°F	Unoccupied Heating UA	6,198 btu/hr/°F		
Unoc Internal Gain factor	0.03	Cooling Occ Enthalpy Setpoint	27.5 Btu/lb				
Ave Occ Internal Gain Factor	0.7	Cooling Unocc Enthalpy Setpoint	27.5 Btu/lb				
Economizer available (Y/N)	Yes						

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS									
					Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load	Ventilation BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load	Ventilation BTUH	Internal Gain BTUH	Available Economizer Cooling kWh	Necessary Cooling Energy kWh	Existing Cooling Energy kWh	therms
A		B	C	D	E	F		G	H	I		J	K	L	M	M
102.5	49.1	0	0	0	-601,377	-363,849		-285,398	-480,508	-150,009		-12,231	0	0	0	0
97.5	42.5	6	2	4	-502,791	-252,673		-285,398	-401,736	-104,173		-12,231	0	423	423	0
92.5	39.5	45	16	29	-404,204	-202,138		-285,398	-322,965	-83,338		-12,231	0	2,645	2,645	0
87.5	36.6	146	52	94	-305,618	-153,288		-285,398	-244,193	-63,198		-12,231	0	6,884	6,884	0
82.5	34.0	298	106	192	-207,031	-109,492		-285,398	-165,421	-45,142		-12,231	0	10,679	10,679	0
77.5	31.6	476	170	306	-108,445	-69,064		-285,398	-86,649	-28,474		-12,231	0	11,772	11,772	0
72.5	29.2	662	237	426	-9,859	-28,636		-285,398	-7,877	-11,806		-12,231	0	9,020	9,020	0
67.5	27.0	740	264	476	27,892	18,192		-285,398	27,892	7,500		-12,231	131	6,328	6,197	0
62.5	24.5	765	273	492	58,883	38,406		-285,398	58,883	15,834		-12,231	812	5,142	4,330	0
57.5	21.4	733	262	471	89,874	58,620		-285,398	89,874	24,168		-12,231	1,582	3,586	2,004	0
52.5	18.7	668	239	430	120,864	78,834		-285,398	120,864	32,502		-12,231	2,079	2,045	0	0
47.5	16.2	659	235	424	151,855	99,048		-285,398	151,855	40,836		-12,231	2,634	812	0	0
42.5	14.4	685	245	441	182,846	119,262		-285,398	182,846	49,170		-12,231	0	0	0	1,261
37.5	12.6	739	264	475	213,837	139,475		-285,398	213,837	57,503		-12,231	0	0	0	1,764
32.5	10.7	717	256	461	244,828	159,689		-285,398	244,828	65,837		-12,231	0	0	0	2,102
27.5	8.6	543	194	349	275,819	179,903		-285,398	275,819	74,171		-12,231	0	0	0	1,888
22.5	6.8	318	114	205	306,810	200,117		-285,398	306,810	82,505		-12,231	0	0	0	1,279
17.5	5.5	245	88	158	337,801	220,331		-285,398	337,801	90,839		-12,231	0	0	0	1,119
12.5	4.1	156	56	100	368,792	240,544		-285,398	368,792	99,172		-12,231	0	0	0	797
7.5	2.6	92	33	59	399,782	260,758		-285,398	399,782	107,506		-12,231	0	0	0	520
2.5	1.0	36	13	23	430,773	280,972		-285,398	430,773	115,840		-12,231	0	0	0	223
-2.5	0.0	19	7	12	461,764	301,186		-285,398	461,764	124,174		-12,231	0	0	0	128
-7.5	-1.5	8	3	5	492,755	321,400		-285,398	492,755	132,508		-12,231	0	0	0	58
TOTALS		8,760	3,129	5,631									7,238	59,336	53,954	11,139
												Savings	$1,166			

Existing Building Ventilation & Infiltration (occ)	**3,743**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**1,543**	**cfm**
Economizer Ventilation (from AHU's)	**2,200**	**cfm**

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Enthalpy Economizer

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	Means Mechanical-2009
Host Computer Complete	1	ea				$ -	$ -	$ -	$ 8,512	
Computer Start up and Checkout labor	3	ea		$ 90		$ -	$ 329	$ -	$ 329	
Programmable Thermostats	10	ea	$ -	$ -	$ 577	$ -	$ -	$ 6,289	$ 6,289	
Outside air Temperature Sensor	1	ea	$ -	$ -		$ -	$ -	$ -	$ -	
Enthalpy Sensor	5	ea	$ -	$ -	$ 927	$ -	$ -	$ 5,052	$ 5,052	
Police Exhaust Fan Relay	0	ea	$ 97	$ 90		$ -	$ -	$ -	$ -	
Police Exhaust Fan Occupancy Sensor	0	ea	$ -	$ -	$ 577	$ -	$ -	$ -	$ -	
Split AC Units	0	ea	$ 97	$ 90		$ -	$ -	$ -	$ -	
Programming Points						$ -	$ -	$ -	$ -	
10 Thermostats, 10 Dampers, 5 Roof Top Unit, 1	16	ea point	$ -	$ 90		$ -	$ 1,757	$ -	$ 1,757	
Fan Relay, 2 Split AC Units, 1 Proposed Condensing Boiler, 1 Outside Air Tempearture						$ -	$ -	$ -	$ -	

$ 21,940	Subtotal
$ 2,193.97	10% Contingency
$ 3,620.04	15% Contractor O&P
$ 2,775	10% Engineering
$ 30,529	**Total**

APPENDIX L

ECM-4d Install Demand Control Ventilation

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM	45,000	2,200	5%	OA from Block load sheet
Derated CFM	45,000	750	2%	OA required fo an Avg of 50 people @ 15 CFM/Per
SA Enthalpy	26.4	BTU/lbma		
SA Set point, Winter	72.0	°F		
SA Set point, Summer	72.0			
Cooling System Eff.	1.20	kW/Ton		(Includes ancillary equipment)
Heating System Eff.	80%			(Includes distribution losses)

Install Demand Control Ventilation

Description:
Outside air can be significantly reduced for most of the time that the building is occupied.
Savings will result from the avoided heating and cooling of excessive outside air.

Method:
The outdoor air introduced into the spaces is currently constant based on design occupancy conditions.
This ECM proposes the installation of CO2 sensors in the space to allow for reduced outdoor air flows when conditions allow.
An average reduction of 50% is assumed possible with the implementation of DCV
The DCV system will automatically adjust the outdoor air damper position through the EMS to reduce outdoor air flows based on indoor CO2 levels.
This ECM has been interacted with the new boiler ECMs and accounts for the reduced operating hours of the unit via EMS scheduling.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	2,200	225	0	0	-	750	77	0	0	-	0	-
97.5	42.5	2	2,200	159	0	34	-	750	54	0	12	-	23	-
92.5	39.5	16	2,200	130	0	209	-	750	44	0	71	-	137	-
87.5	36.6	52	2,200	101	0	527	-	750	34	0	180	-	347	-
82.5	34	106	2,200	75	0	801	-	750	26	0	273	-	528	-
77.5	31.6	170	2,200	51	0	876	-	750	18	0	298	-	577	-
72.5	29.2	237	2,200	28	0	656	-	750	9	0	224	-	432	-
67.5	27	264	2,200	0	11	0	35	750	0	4	0	12	0	23
62.5	24.5	273	2,200	0	23	0	77	750	0	8	0	26	0	51
57.5	21.4	262	2,200	0	34	0	113	750	0	12	0	38	0	74
52.5	18.7	239	2,200	0	46	0	138	750	0	16	0	47	0	91
47.5	16.2	235	2,200	0	58	0	171	750	0	20	0	58	0	113
42.5	14.4	245	2,200	0	70	0	214	750	0	24	0	73	0	141
37.5	12.6	264	2,200	0	82	0	271	750	0	28	0	92	0	178
32.5	10.7	256	2,200	0	94	0	301	750	0	32	0	102	0	198
27.5	8.6	194	2,200	0	106	0	256	750	0	36	0	87	0	169
22.5	6.8	114	2,200	0	118	0	167	750	0	40	0	57	0	110
17.5	5.5	88	2,200	0	129	0	142	750	0	44	0	48	0	93
12.5	4.1	56	2,200	0	141	0	99	750	0	48	0	34	0	65
7.5	2.6	33	2,200	0	153	0	63	750	0	52	0	21	0	42
2.5	1	13	2,200	0	165	0	27	750	0	56	0	9	0	17
-2.5	0	7	2,200	0	177	0	15	750	0	60	0	5	0	10
-7.5	-1.5	3	2,200	0	189	0	7	750	0	64	0	2	0	4
Total		**3,129**		**769.2**		**3,102**	**2,089**		**262.2**		**1,057**	**712**	**2,044**	**1,377**

100% Energy Cost Savings		
Heating Savings	1,377	therms
Cooling Savings	2,044	kWh

Comments:

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Install Demand Control Ventilation

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	Means Mechanical-2009
Host Computer Complete	1	ea				$ -	$ -	$ -	$ 8,512	
Computer Start up and Checkout labor	3	ea		$ 67		$ -	$ 245	$ -	$ 245	
Programmable Thermostats	0	ea	$ -	$ -	$ 577	$ -	$ -	$ -	$ -	
Outside air Temperature Sensor	1	ea	$ -	$ -		$ -	$ -	$ -	$ -	
Enthalpy Sensor	5	ea	$ -	$ -	$ 927	$ -	$ -	$ 5,052	$ 5,052	
Police Exhaust Fan Relay	1	ea	$ 97	$ 24		$ 96	$ 29	$ -	$ 125	
Police Exhaust Fan Occupancy Sensor	0	ea	$ -	$ -	$ 577	$ -	$ -	$ -	$ -	
Split AC Units	0	ea	$ 97	$ 24		$ -	$ -	$ -	$ -	
Programming Points						$ -	$ -	$ -	$ -	
5 Roof Top Unit, 1 Fan Relay1 Outside Air Tempearture Sensor	7	ea point	$ -	$ 67		$ -	$ 572	$ -	$ 572	
						$ -	$ -	$ -	$ -	

$ 14,507	Subtotal
$ 1,450.69	10% Contingency
$ 2,393.63	15% Contractor O&P
$ 1,835	10% Engineering
$ 20,186	**Total**

APPENDIX M

ECM-4e Energy Management Control System

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Energy Management Control System (Including 4a, 4b, 4c 4d)

Multipliers	
	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	Means Mechanical-2009
Host Computer Complete	1	ea				$ -	$ -	$ -	$ 8,512	
Computer Start up and Checkout labor	3	ea		$ 90		$ -	$ 329	$ -	$ 329	
Programmable Thermostats	10	ea	$ -	$ -	$ 577	$ -	$ -	$ 6,289	$ 6,289	
Outside air Temperature Sensor	1	ea	$ -	$ -		$ -	$ -	$ -	$ -	
Enthalpy Sensor	5	ea	$ -	$ -	$ 927	$ -	$ -	$ 5,052	$ 5,052	
Police Exhaust Fan Relay	1	ea	$ 97	$ 90		$ 96	$ 110	$ -	$ 206	
Police Exhaust Fan Occupancy Sensor	1	ea	$ -	$ -	$ 577	$ -	$ -	$ 629	$ 629	
Split AC Units	2	ea	$ 97	$ 90		$ 192	$ 220	$ -	$ 412	
Programming Points						$ -	$ -	$ -	$ -	
10 Thermostats, 10 Dampers, 5 Roof Top Unit, 1 Fan Relay, 2 Split AC Units, 1 Proposed Condensing Boiler, 1 Outside Air Tempearture	20	ea point	$ -	$ 90		$ -	$ 2,196	$ -	$ 2,196	
						$ -	$ -	$ -	$ -	

$ 23,625	Subtotal
$ 2,362.53	10% Contingency
$ 3,898.17	15% Contractor O&P
$ 2,989	10% Engineering
$ 32,875	**Total**

APPENDIX N

ECM-5 Condensing Boiler Installation

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station
Install Boilers

Existing Fuel	Electric
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 0.16		
Proposed Fuel Cost	$ 1.50		
Baseline Fuel Use	31,960	kWh	Based on calculated historical utility data
Existing Boiler Plant Efficiency	100%		Estimated or Measured
Baseline Boiler Load	109,081	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 3.413 Mbtu/kWh
Baseline Fuel Cost	$ 5,150		
Proposed Boiler Plant Efficiency	92%		New Boiler Efficiency
Proposed Fuel Use	1,186	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 1,774		
Annual Savings	31,960	kWh	
	(1,186)	Therms	
Annual Savings	**$ 3,376**	**/yr**	

*Note to engineer: Link savings back to summary sheet in appropriate column.

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Install Boilers

Multipliers	
Material:	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
New high efficiency boilers (194 mBh Condensing Boiler)	1	ea.	2550	$ 920		$ 2,525	$ 1,122	$ -	$ 3,647	Means Mechanical Cost Data - 2009
Boiler - Mechanical removal: Disconnect hot water piping and gas piping to the existing boilers	2	Lot		$ 500		$ -	$ 1,220	$ -	$ 1,220	Means Mechanical Cost Data - 2009
Disconnect electrical	2	Lot		$ 500		$ -	$ 1,220	$ -	$ 1,220	Means Mechanical Cost Data - 2009
Install new boilers. Reconnect the gas and hot water piping; install new stack material to new location.	1	Lot	$ 2,000	$ 2,000		$ 1,980	$ 2,440	$ -	$ 4,420	Means Mechanical Cost Data - 2009
Boiler Startup	1	Lot		$ 500		$ -	$ 610	$ -	$ 610	1 day startup

$ 11,117	Subtotal	
2223.38	20%	Contingency
2001.042	15%	Contractor O&P
$ 1,534	10%	Engineering
$ 16,875	**Total**	

APPENDIX O

ECM-6 Replace Domestic Hot Water Heater

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Replace DHW Heater

Occupants	50
Gallon/Occ	1.2
Days/Year	365
Gallons/Year	21,900
Btu/Year	119
BTU/Month	10

Btu=Gal/yr x 8.33 Lb/Gallon x 1.0 SH x (120-55 deg) Delta T / 100000

Summary

* Replace 180 MBH, 97 Gal Gas-Fired DHW Heater w/ Instantaneous, Condensing, Gas-Fired DHW Heater

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	**10**	Therms/month	Calculated from utility bill
Total Annual Utility Demand by Water Heater	11,858	MBTU/yr	1therm = 100 MBTU
Existing DHW Heater Efficiency	100%		Per manufacturer nameplate
Total Annual Hot Water Demand (w/ standby losses)	11,858	MBTU/yr	
Existing Tank Size	80	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	10	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	120	˚F	Per building personnel
Room Temperature	70	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.9	MBH	
Annual Standby Hot Water Load	8,213	MBTU/yr	
New Tank Size	0	Gallons	Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Hot Water Piping System Capacity	10	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	120	˚F	
Room Temperature	70	˚F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.1	MBH	
Annual Standby Hot Water Load	913	MBTU/yr	
Total Annual Hot Water Demand	4,558	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Takagi Flash T-H1 instantaneous, condensing DHW Heater
Proposed Fuel Use	50	Therms	Standby Losses and inefficient DHW heater eliminated
Utility Cost	$1.50	$/Therm	
Utility Cost	$0.16	$/kWh	
Existing kWh/Year	3,475	kWh/year	
Existing Operating Cost of DHW	$560	$/yr	
Proposed Operating Cost of DHW	$74	$/yr	

Savings Summary:

Utility	Energy Savings	Cost Savings
Existing kWh/Year	3,475	$560
Proposed Therms/yr	-50	-$74
Net Cost Savings		$486

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Replace DHW Heater

Multipliers	
Material:	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
ELE DHW Heater Removal	1	LS		$ 50		$ -	$ 61	$ -	$ 61	
						$ -	$ -	$ -	$ -	
Instantaneous Gas-Fired DHW Heater	1	EA	$ 1,725	$ 297		$ 1,708	$ 362	$ -	$ 2,070	
Miscellaneous Electrical	1	LS	$ 500			$ 495	$ -	$ -	$ 495	
Venting Kit	1	EA	$ 450	$ 650		$ 446	$ 793	$ -	$ 1,239	
Miscellaneous Piping 3/4 in	50	LS	$ 6	$ 5		$ 297	$ 314	$ -	$ 611	
Miscellaneous Valves 3/4 in	5	LS	$ 17	$ 20		$ 84	$ 122	$ -	$ 206	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 4,682	Subtotal	
$ 468	0.1	Contingency
$ 773	0.15	Contractor O&P
$ 592	0.1	Engineering
$ 6,515	**Total**	

APPENDIX P

ECM-7 Water Conservation

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Replace urinals and flush valves with low flow types

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$8.00	$ / kGal
Urinals in Building	4	
Average Flushes / Urinal (per Day)	12	
Average Gallons / Flush	1.5	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	4	
Proposed Gallons / Flush	1.0	Gal
Proposed Material Cost	$360	
Proposed Installation Cost	$269	
Total cost of new urinals & valves	$2,515	

SAVINGS		
Current Urinal Water Use	26	kGal / year
Proposed Urinal Water Use	18	kGal / year
Water Savings	9	kGal / year
Cost Savings	$70	/ year
Simple Payback	35.9	years

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

ECM 8.2 Replace Toilets and Flush Valves with Low Flow Units

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$8.00	$ / kGal
Toilets in Building	18	
Average Flushes / Toilet (per Day)	10	
Average Gallons / Flush	3.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	18	
Proposed Gallons / Flush	1.6	Gal
Proposed Material Cost of new Flush Valves	$315	
Proposed Installation cost of new Flush Valves	$139	
Total cost of new toilets & valves	$8,168	

SAVINGS		
Current Toilet Water Use	230	kGal / year
Proposed Toilet Water Use	105	kGal / year
Water Savings	125	kGal / year
Cost Savings	$999	/ year
Simple Payback	8.2	years

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Building: Town Hall-Police Station

Install low flow faucets

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$8.00	$ / kGal
Faucets in Building	15	
Average Uses / Faucet (per day)	50	Gal
Average Gallons / Use	3	Gal

PROPOSED CONDITIONS		
Proposed Faucets to be Replaced	15	
Proposed Gallons / Use	1.5	Gal
Proposed Material Cost of new Faucets	$105	
Proposed Installation cost of new Faucets	$56	
Total cost of new faucets	$2,419	

SAVINGS		
Current Faucet Water Use	821	kGal / year
Proposed Faucet Water Use	411	kGal / year
Water Savings	411	kGal / year
Cost Savings	$3,285	/ year
Simple Payback	0.7	years

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556
Town Hall-Police Station

Install low flow showerheads

Police Station Showers		
EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$8.00	$ / kGal
Showers in Building	3	
Average Uses / shower (per day)	10	
Time in shower	5	Minutes
Old Flow / Showerhead	2.50	GPM
Average Gallons / Use	375	Gal/Day

PROPOSED CONDITIONS		
Proposed showers to modify	3	
Proposed Flow / Showerhead	1.6	Gal
Proposed Average Gallons / Use	240.0	Gal/Day
Proposed Material Cost of new	$15	
Proposed Installation cost of new	$19	
Total cost of new showerheads	$101	

SAVINGS		
Current Shower Water Use	137	kGal / year
Proposed Shower Water Use	88	kGal / year
Water Savings	49	kGal / year
Cost Savings	$394	/ year
Simple Payback	0.3	/ year

APPENDIX Q

New Jersey Pay For Performance Incentive Program

Roxbury Township Town Hall and Police Station Building
CHA Project No. 20556

New Jersey Pay For Performance Incentive Program

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

	Annual Utilities	
	kWh	Therms
Existing Usage	581,360	10,092
Proposed Savings*	59,713	3,265
Existing Total MMBtus	2,993	
Proposed Savings MMBtus	530	
% Reduction	17.7%	
Proposed Annual Savings*	$14,510	

* Does not include savings for lighting measures with prescriptive incentives.

0.5 * Maximum allowable incentiv

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

0.8 * Maximum allowable incentiv

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

	Incentives $		
	Elec	Gas	Total
Incentive #2	$6,568	$3,591	$10,160
Incentive #3	$4,180	$2,285	$6,465
Totals	**$10,748**	**$5,876**	**$16,625**

Total Project Cost	$64,281
% Incentives of Project Cost*	25.9%
Project Cost w/ Incentives*	$47,656

Project Payback (years)	
w/o Incentives	w/ Incentives
4.4	3.3

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

EPA Portfolio Manager:

	kWh	Therms
Proposed Savings	79,554	3,265
Proposed Savings MMBtus	598	
% Reduction	20.0%	

* Includes savings for lighting measures with prescriptive incentives.

APPENDIX R

Photovoltaic (PV) Rooftop Solar Power Generation

AC Energy & Cost Savings

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	50.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	38.5 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	14.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	4139	579.46
2	4.05	4469	625.66
3	4.58	5422	759.08
4	4.84	5299	741.86
5	5.30	5838	817.32
6	5.33	5506	770.84
7	5.27	5561	778.54
8	5.25	5503	770.42
9	5.06	5338	747.32
10	4.46	5027	703.78
11	3.15	3588	502.32
12	2.87	3460	484.40
Year	4.46	59150	8281.00

Output Hourly Performance Data

Output Results as Text

About the Hourly Performance Data

Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

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

Cautions for Interpreting the Results

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

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

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

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

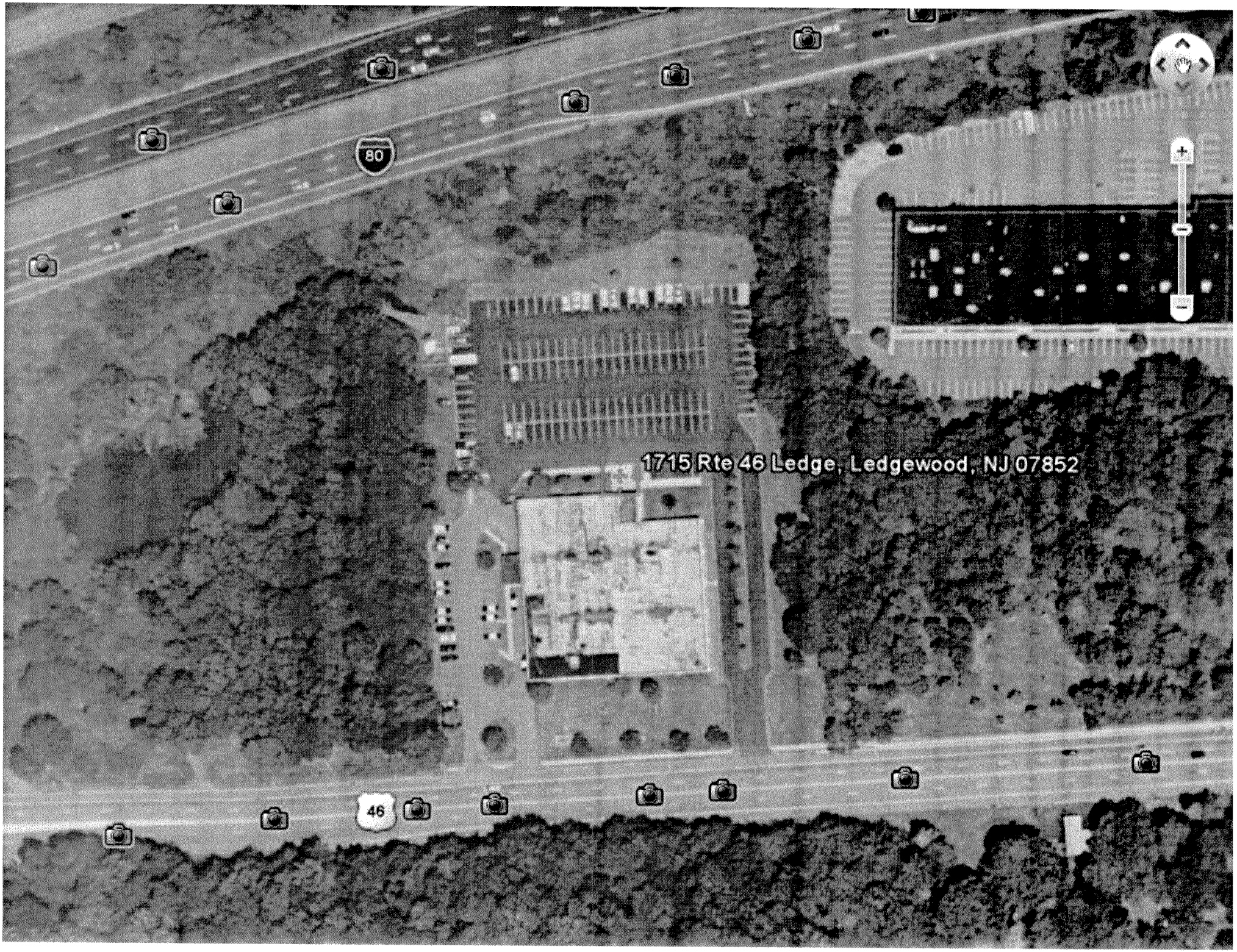
The PV system size is the nameplate DC power rating. The energy production values in the table are valid only for crystalline silicon PV systems.

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

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

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

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


80
1715 Rte 46 Ledge, Ledgewood, NJ 07852
46

Roxbury Township - Town Hall/Police Department Building

Cost of Electricity $0.16 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-50kW System

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	New Jersey Renewable * Energy Incentive	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$500,000	**0.0**	**59,150**	**0**	**$9,531**	**0**	**$9,531**	**$50,000**	**$28,786**	**52.5**	**11.7**

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

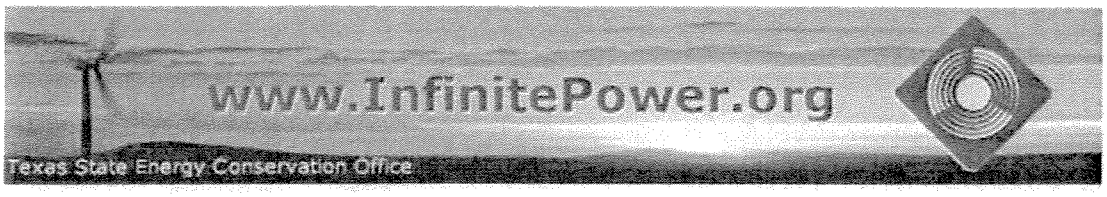
** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

Estimated Solar Renewable Energy Certificate Program (SREC) payments for 15 Years from RR Renewable Energy Consultants

Year	SREC
1	600
2	600
3	600
4	500
5	500
6	500
7	500
8	500
9	500
10	500
11	400
12	400
13	400
14	400
15	400
AVG	**487**

APPENDIX S

Solar Thermal Domestic Hot Water Plant



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SOLAR WATER HEATING CALCULATOR

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

Water heating is a major energy consumer. Although the energy consumed daily is often less than for air conditioning or heating, it is required year round, making it a good application of solar energy.

Use this calculator to explore the energy usage of your water heater, and to estimate whether a solar water heater could save you money.

Water Heater Characteristics			
Physical		**Thermal**	
? Diameter (feet)	1.5	? Water Inlet Temperature (Degrees F)	58
? Capacity (gallons)	80	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	32.05	? Hot Water Temperature (Degrees F)	125
? Effective R-value	36	? Hot Water Usage (Gallons per Day)	120
Energy Use			
2750		? Heat Delivered in Hot Water (BTU/hr)	
48.97		? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		**Electric**
0	? Overall Efficiency	0.9629
0	? Conversion Efficiency	0.98
NaN BTU/hr	? Power Into Water Heater	2856 BTU/hr
Cost		
$ 0.40 /Therm	? Utility Rates	$ 0.15 /kWh
$ NaN	? Yearly Water Heating Cost	$ 1099.09
How Does Solar Compare?		
? Solar Water Heater Cost: $ 0		? Percentage Solar: 0
NaN years for gas	? Payback Time for Solar System	NaN years for electric

Roxbury Township - Town Hall/Police Department Building

$/kWh	$ 0.16	$/kWh	Electric DHW Heater
Btu/hr savings Savings	2,856	Btu/Hr	Infiinate calculator Btu/hr Savings 1.5 Gallon/Day per Occupant (80 Avg Occ through out the day)= 120 Gallon/day
Hours/Year	4,000	Hr	Assume 4000 hours per year to account for Town Hall operation and 24 hr/day Poilce station
Btu/kWh	3,412	Btu/kWh	
kWh Saving/Yr	3,348	kWh/Year	

Solar Thermal Domestic Hot Water Plant

Budgetary	Annual Utility Savings				Estimated	Total	New Jersey Renewable	Payback	Payback
Cost					Maintenance Savings	Savings	Energy Incentive	(without incentive)	(with incentive)
$	kW	kWh	Gallons	$	$	$	$	Years	Years
$5,691	**0.0**	**3,348**	**0**	**$540**	**0**	**$540**	**$0**	**10.5**	**10.5**

*No Incentive available for the New Jersey renewable energy program at this time.

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.07

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
Synergy Solar Thermal System	1	ea				$ -	$ -	$ 3,600	$ 3,600	
80 GallonStorage Tanks	1	ea	$ 350	$ 200		$ 350	$ 200	$ -	$ 550	
15 Gallon Drip Tank	1	ea	$ 150	$ 78		$ 150	$ 78	$ -	$ 228	
						$ -	$ -	$ -	$ -	

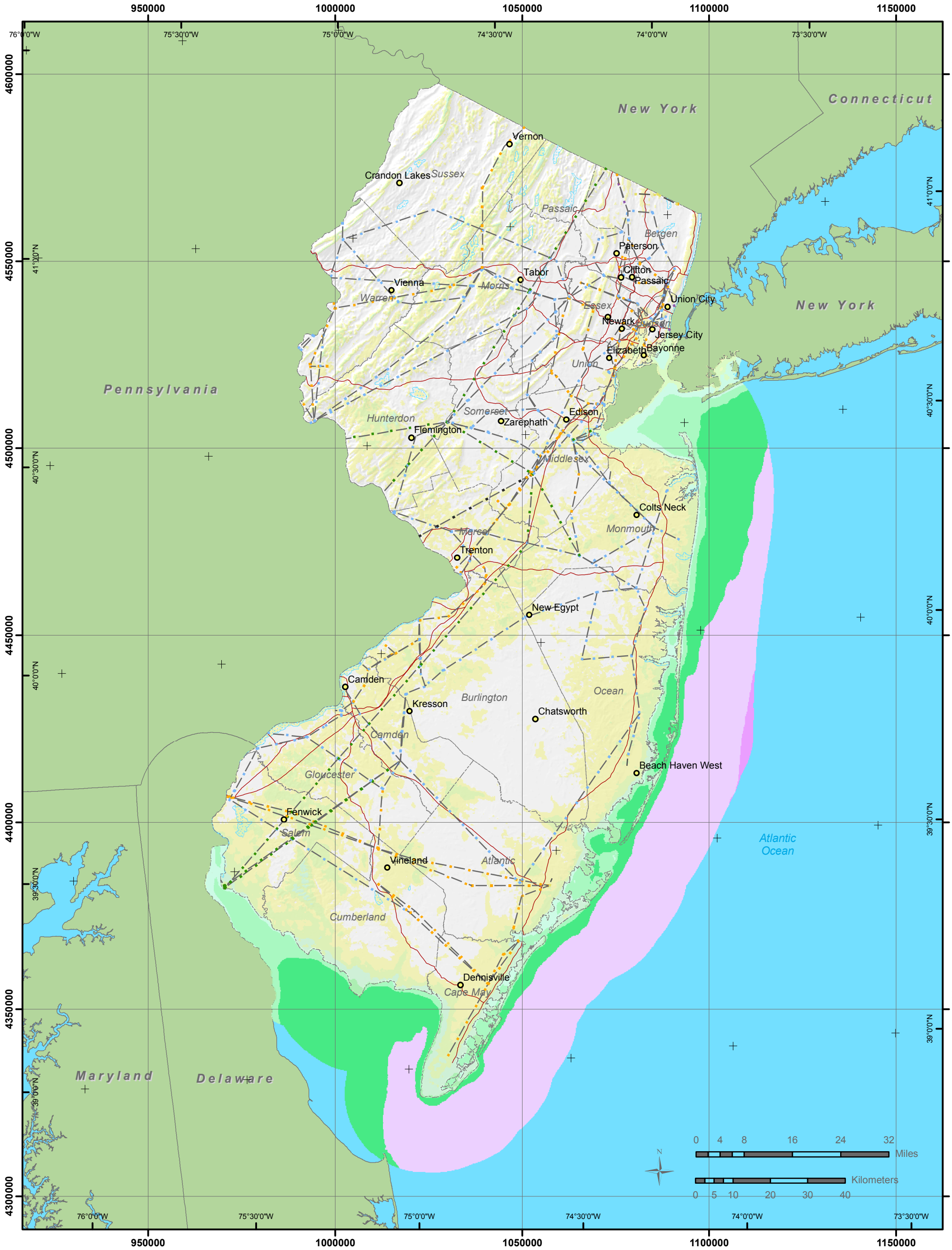
$ 4,378	Subtotal
$ 438	10% Contingency
$ 438	10% Contractor O&P
$ 438	10% Engineering
$ 5,691	**Total**

APPENDIX T

Wind

Wind Resource of New Jersey

Mean Annual Wind Speed at 30 Meters



Features

- City
- Interstate Highway
- County Boundary
- Water Body

Generalized Transmission Line

Category

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

Mean Speed at 30 m

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

AWS Truewind

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

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

APPENDIX U

EPA Portfolio Manager

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Town Hall/Police Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	1715 Route 46, Ledgewood, NJ 07852	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Town Hall (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	20,670 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	90	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	85	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Police Department (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑

Gross Floor Area	7,930 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		
Number of PCs	25 (Optional)	Is this the number of personal computers in the space?		
Weekly operating hours	168 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		
Workers on Main Shift	25 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

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

Fuel Type: Electricity

Meter: Electric Meter Act #100000258440 (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	40,800.00
11/01/2008	11/30/2008	47,120.00
10/01/2008	10/31/2008	48,160.00
09/01/2008	09/30/2008	51,920.00
08/01/2008	08/31/2008	51,520.00
07/01/2008	07/31/2008	63,280.00
06/01/2008	06/30/2008	52,880.00
05/01/2008	05/31/2008	42,880.00
04/01/2008	04/30/2008	47,440.00
03/01/2008	03/31/2008	41,200.00
02/01/2008	02/29/2008	44,160.00
01/01/2008	01/31/2008	50,000.00
Electric Meter Act #100000258440 Consumption (kWh (thousand Watt-hours))		**581,360.00**
Electric Meter Act #100000258440 Consumption (kBtu (thousand Btu))		**1,983,600.32**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,983,600.32**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas Meter Act #01-1101-0641-39 (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	2,509.00
11/01/2008	11/30/2008	738.00
10/01/2008	10/31/2008	243.00
09/01/2008	09/30/2008	37.00
08/01/2008	08/31/2008	10.00
07/01/2008	07/31/2008	13.00
06/01/2008	06/30/2008	65.00
05/01/2008	05/31/2008	223.00
04/01/2008	04/30/2008	456.00
03/01/2008	03/31/2008	1,436.00

02/01/2008	02/29/2008	2,072.00
01/01/2008	01/31/2008	2,290.00
Natural Gas Meter Act #01-1101-0641-39 Consumption (therms)		**10,092.00**
Natural Gas Meter Act #01-1101-0641-39 Consumption (kBtu (thousand Btu))		**1,009,200.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,009,200.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Town Hall/Police Building
1715 Route 46
Ledgewood, NJ 07852

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Town Hall/Police Building	
Gross Floor Area Excluding Parking: (ft^2)	28,600
Year Built	1974
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Town Hall	
Space Type	Office
Gross Floor Area(ft^2)	20,670
Weekly operating hours	40
Workers on Main Shift	90
Number of PCs	85
Percent Cooled	50% or more
Percent Heated	50% or more

Police Department	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	7,930
Number of PCs°	25
Weekly operating hours°	168
Workers on Main Shift°	25

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	50	N/A
Energy Intensity					
Site (kBtu/ft2)	105	105	62	84	77
Source (kBtu/ft2)	269	269	160	216	182
Energy Cost					
$/year	$ 108,777.09	$ 108,777.09	$ 64,648.77	$ 87,414.62	$ 80,044.30
$/ft2/year	$ 3.80	$ 3.80	$ 2.26	$ 3.05	$ 2.80
Greenhouse Gas Emissions					
$MtCO_2e$/year	356	356	212	286	262
$kgCO_2e/ft^2$/year	12	12	7	10	9

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

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