TOWNSHIP OF ANDOVER
NEWTON, NJ
ANDOVER TOWNSHIP POLICE DEPARTMENT
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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CHA PROJECT NO. 20997

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TABLE OF CONTENTS

Page

APPENDICES

1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit performed at the Andover Township Police Department, in the Township of Andover located on Lake Iliff Road in Andover, NJ. Built in 2004, the building is a 6,400 square foot, single story structure. The building houses a 911 call/dispatch center, patrol room, holding cells, records rooms, offices for police personnel, and auxiliary spaces.

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 covers the energy audit for the Andover Township Police Department.

2.0 EXECUTIVE SUMMARY

This report details the results of the energy audit performed at the Andover Township Police Department, in the Township of Andover located on Lake Iliff Road in Andover, NJ. The 6,400 square foot, single story structure houses a 911 call/dispatch center, patrol room, holding cells, records rooms, offices for police personnel, and auxiliary spaces.

It should be noted that this facility was constructed with many energy saving measures such as; geothermal HVAC systems, energy efficient lighting, energy efficient domestic hot water heating, and low water use plumbing fixtures.

Due to these built in energy efficiencies, the available energy conservation measures (ECM) for this facility are very limited. Thus, only the following ECM was available for evaluation:

- Lighting control modifications with occupancy sensors

This potential Energy Conservation Measure (ECM) was identified and recommended for implementation because it has a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of $650 for the recommended ECMs may be realized with a payback of 1.7 years.

The ECM 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 ECM follows:

ECM-1 Lighting Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,400	0	3,400	0	550	4.9	300	2.5	2.0

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of fifteen wall-mounted occupancy sensors.

3.0 EXISTING CONDITIONS

3.1 Building General

The Newton, NJ, Andover Township Police Department facility was constructed in 2004, and is a 6,400 square foot, single story structure. The building houses a 911 call/dispatch center, patrol room, holding cells, records rooms, offices for police personnel, and auxiliary spaces.

Andover Township's police department houses police officer offices and records storage, as well as a 911/dispatch center. As such, one wing of the building, which houses the dispatch center, patrol room, and holding cells, operates around the clock, while the other wing, which includes records rooms, offices for police personnel, and auxiliary spaces, operates on a traditional 40 hours per week schedule. Within this report the wing that operates around the clock is referred to as the operational wing and the other wing is referred to as the administration wing.

The building was constructed in 2004 and the building's exterior shell is in good condition. The exterior wall consists of 8" split face block with insulated inserts and 3" rigid insulation within 3-5/8" metal studs. The interior wall is 5/8" painted gypsum board. The roof is pitched on wood truss. The roof is made of fiberglass shingles on 15 lb felt and 5/8" CDX plywood sheathing. R-38 fiberglass insulation is provided on 5/8" gypsum board attached to the bottom cord of the truss. There is a dropped acoustical tile ceiling below except in the garage, utility room, interview rooms, and evidence room where the gypsum board is exposed and painted.

The exterior windows are fixed, low-E, argon filled double pane. The exterior entrance door is a double 3'x7' glass door with aluminum frame. The side entrance door is a 3'x7' insulated hollow metal door with 4"x31" vision glass panel. The garage door is 10'x10' steel with an expanded polystyrene core.

The building was designed with many energy savings considerations, such as, geothermal HVAC systems, energy saving lighting, and providing domestic water from well water. In the original design desuperheaters were proposed to preheat domestic water entering the water heaters with waste heat from the geothermal system, but were never installed. Due to the energy efficiencies designed and constructed into the original building, the energy use within this facility has been reduced considerably when compared to similar use facilities.

3.2 Utility Usage

Utilities include electricity and potable water. Electricity is purchased from Jersey Central Power & Light Company (JCP&L) and potable water is provided by an on-site well. There is no natural gas within the building.

During the period of January 2009 to December 2009, electric usage was approximately 119,300 kWh at a total cost of about $19,300. Review of electricity bills during this period determined the building was charged a supply unit cost of $0.12 per kWh, demand unit cost of $4.93 per kW, and blended unit cost of $0.1616 per kWh. The maximum demand was 34.6 kW and occurred in February 2009. Electricity usage was highest in the winter and summer seasons when supplemental heat or cooling equipment is in use. Utility data can be found in Appendix A.

Electricity supply and delivery is presently purchased from JCP&L. The delivery component will always be the responsibility of the utility that connects the facility to the power grid; however, the supply can be purchased from a third party. The electricity supply entity will require submission of one to three years of

past energy bills. Contract terms can vary among suppliers. A list of approved electricity suppliers can be found in Appendix A.

3.3 HVAC Systems

Ventilation and air conditioning is provided to each wing of the facility by water source heat pumps utilizing an open loop system and five wells. Cooling and heating is provided by Water Furnace water source heat pumps with supplemental heat provided by Indeeco electric duct heaters. One set of heat pump/electric duct heater is dedicated to the operational wing, and the other set is dedicated to the administration wing. Both units serve a portion of the shared corridor.

In total, the two heat pumps supply 4,025 CFM air, including 1,098 CFM of outdoor air (OA).

The following is a summary of this equipment and areas served:

Equipment	Cooling MBH / EER 86 °F EWT	Heating MBH / COP 68 °F EWT	Heating EDH kW	Area Served
AC-1 & EDH-1	44.9 / 12.3	56.2 / 4.2	18	Operational Wing
AC-2 & EDH-2	77.9 / 13.1	95.0 / 4.7	13	Administration Wing

There are 8 exhaust fans located throughout the building serving the restrooms and the utility room.

The geothermal system includes a single submersible well pump in the supply well. The pump has a capacity of 30 gallons per minute and has the following electrical characteristics, 208V/1 HP/1 Phase. The other well in the geothermal system is an injction well and does not contain a pump.

The equipment is original to the building and installed in 2004 (6 years old). Service life is estimated at 24 years for heat pump systems of this type. A list of HVAC equipment can be found in Appendix B.

3.4 Lighting/Electrical Systems

The majority of lighting fixtures throughout the facility utilize two, three, or four, energy efficient T-8 fluorescent lamps with electronic ballast. All exit signs within the building use LED lamps.

Exterior building lighting, located at exterior doors and parking areas, includes downlights, flood lights, and pole mounted lights. All of the exterior lighting is provided by metal halide lamps.

Emergency power is provided by a 100 kW, diesel generator with a base tank. The unit powers the entire building. The unit is located outside the facility adjacent to the garage.

3.5 Control Systems

3.5.1 HVAC Controls

Each heat pump and duct heater combination is controlled by wall-mounted, 24/7 programmable, thermostat with occupied and unoccupied cycle. AC-1/EDH-1 is controlled by an average of two thermostats, one located in the dispatch center and one located in the patrol room. The thermostat for AC-2/EDH-2 is located in the chief's office.

Following are the existing occupied and unoccupied heating and cooling setpoints for each AHU and EDH combination:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
AC-1 & EDH-1	74°F / 74°F	76°F / 80°F
AC-2 & EDH-2	70°F / 62°F	76°F / 80°F

* Note the operational wing is utilized 24 hours/day, 7 days/week

The restroom exhaust fans are operated via the light switch. The utility room exhaust fan is controlled by an electronic thermostat set to 85 °F.

3.5.2 Lighting Controls

Lighting in the facility is controlled by manual wall switches. All exterior lighting is controlled by photocells.

3.6 Plumbing Systems

Domestic hot water for the facility is produced by two electric water heaters. One water heater is 40 gallons, 4 kW, and provides hot water to the locker area. The water heater is located in the unfinished women's locker area. The other water heater is 20 gallons, 1.6 kW, and provides hot water to the other restrooms and kitchenette. The water heater is located in the utility room.

Plumbing fixtures include 1.6 gallon per flush, pressure assist, tank type water closets; countertop restroom sinks; service sink; urinals; ADA compliant showers; kitchen sink; and exterior non-freeze wall hydrants. All flush valves and faucets meet the maximum water flow requirements of the adopted plumbing codes. Domestic water for the facility is provided from an on-site well.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Lighting Control Modifications

Lighting throughout the facility is currently controlled by manual wall switches. By equipping non-critical areas with motion sensors, unoccupied energy use can be greatly reduced. This ECM proposes the addition of fifteen wall-mounted occupancy sensors in non-critical rooms. Non-critical rooms are rooms that are not utilized around the clock.

The weekly occupied times for each space was determined by taking into account typical traffic patterns for the administration end of the building. Applying the existing and proposed operating times to the combined wattage requirements for each room's lighting fixtures, it was determined that about 3,400 kWh per year, or $550 per year, can be saved through implementation of this ECM.

Occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 51,000 kWh and $8,250.

Supporting calculations, including the proposed rooms to install occupancy sensors; assumptions for lighting hours in each space; annual energy usage for each fixture; and the type of occupancy sensor recommended is included in Appendix C. The implementation cost and savings related to this ECM are summarized below:

ECM-1 Lighting Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,400	0	3,400	0	550	4.9	300	2.5	2.0

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of fifteen wall-mounted occupancy sensors.

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

The building will be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives will be from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities whose demand in any of the preceding 12 months exceeds 200 kW. However, the 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. American Recovery and Reinvestment Act (ARRA) funding, when available, may allow oil, propane and municipal electric customers to be eligible for the P4P Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy saving and designed to pay approximately 60% of the total performance-based incentive. Base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool. 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 provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

5.1.2 New Jersey Smart Start Program

For this program, specific incentives for energy conservation measures are calculated on an individual basis utilizing the 2010 New Jersey Smart Start incentive program. This program provides incentives dependent upon mechanical and electrical equipment. If applicable, incentives from this program are reflected in the ECM summaries and attached appendices.

If the building qualifies and enters into the New Jersey Pay for Performance Program, all energy savings will be included in the total building energy reduction, and savings will be applied towards the Pay for Performance incentive. A project is not applicable for both New Jersey incentive programs.

5.1.3 Energy Efficient and Conservation Block Grant

Following is a brief summary of the Energy Efficient and Conservation Block Grant (EECBG) program. The Energy Efficiency and Conservation Block Grant Complete Program Application Package should be consulted for rules and regulations.

Additional funding is available to local government entities through the EECBG, a part of New Jersey's Clean Energy program (NJCEP). The grant is for local government entities only, and can offset the cost of energy reduction implementation to a maximum of $20,000 per building.

This program is provided in conjunction with NJCEP funding and any utility incentive programs; the total amount of the three incentives combined cannot exceed 100% of project cost. Funds shall first be provided by NJCEP, followed by the EECBG and any utility incentives available to the customer. The total amount of the incentive shall be determined TRC Solutions, a third party technical consulting firm for the NJCEP.

In order to receive EECBG incentives, local governments must not have received a Direct Block Grant from the US Department of Energy. A list of the 512 qualifying municipalities and counties is provided on the NJCEP website. Qualifying municipalities must participate in at least one eligible Commercial & Industrial component of the NJCEP, utility incentive programs, or install building shell measures recommended by the Local Government Energy Audit Program. Eligible conservation programs through NJCEP include:

- Direct Install
- Pay for Performance
- NJ SmartStart Buildings for measures recommended by a Local Government Energy Audit (LGEA) or an equivalent audit completed within the last 12 months
- Applicants may propose to independently install building shell measures recommended by a LGEA or an equivalent audit. The audit must have been completed within the past 12 months.
- Any eligible utility energy efficiency incentive program

Most facilities owned or leased by an eligible local government within the State of New Jersey are eligible for this grant. Ineligible facilities include casinos or other gambling establishments, aquariums, zoos, golf courses, swimming pools, and any building owned or leased by the United States Federal Government. New construction is also ineligible.

5.1.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

The American Recovery and Reinvestment Act (ARRA) Initiative is available to New Jersey oil, propane, cooperative and municipal electric customers who do not pay the Societal Benefits Charge. This charge can be seen on any electric bill as the line item "SBC Charge." Applicants can participate in this program in conjunction with other New Jersey Clean Energy Program initiatives including Pay for Performance, Local Government Energy Audits, and Direct Install programs.

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount

of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

Additional information is available on New Jersey's Clean Energy Program website.

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

The building is not eligible for the three incentives available from the New Jersey P4P program as it does not meet the 15% energy reduction required.

5.2.2 New Jersey Smart Start Program

The Andover Township Police Department is eligible for incentives from the New Jersey Smart Start Program.

The lighting control modifications measure is eligible for $300 in savings for the installation of fifteen wall mounted occupancy sensors.

5.2.3 Energy Efficient and Conservation Block Grant

The Andover Township Police Department is owned by local government which makes it eligible for this incentive. The incentive amount is determined by TRC Solutions and is not calculable at this time. Further information about this incentive, including the application, can be found at: http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants

5.2.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

Based on the utility information that was provided by the borough for the police department, it was be determined that the building pays for the societal benefits charge. The police department building could be eligible for additional funding through this program.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 Solar

6.1.1 Photovoltaic Rooftop Solar Power Generation

The facility 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 Energy Program recommends the use of the PVWATTS program to determine solar grid tied system production. Version 2 of the program was used, allowing the zip code of the police department building to be analyzed. A fixed tilt array type was utilized to calculate energy production. The PVWATTS solar power generation model is provided in Appendix D. Additionally, further financial analysis was provided by www.solar-estimate.org. The result of this analysis is also located in Appendix D.

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 of 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 building had a maximum kW demand of 34.6 kW and a minimum of 19.8 kW over the previous 12 months. The monthly average over the observed 12 month period was 27.43 kW. Because the most frequent monthly demand is approximately 30 kW, a 30 kW system size was selected for the calculations. The system costs for PV installations were derived from average installation costs for this area. It should be noted that the cost of installation is currently $8 per watt or $8,000 per kW of installed system. 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.

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

Photovoltaic (PV) Rooftop Solar Power Generation – 30 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	$	$	$	$/yr	Years	Years
240,000	0	33,512	0	5,400	5,400	30,000	16,300	>25	~5

*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

Based on the above, it is recommended that a third party power purchase agreement (PPA) be considered to take advantage of the investment tax credit, reduce the cost of the system to the township, and provide a guaranteed reduced cost of power.

6.1.2 Solar Thermal Hot Water Plant

Active solar water-heating systems for buildings use solar collectors to absorb the sun's energy to heat a fluid, either a liquid or air. The collector would then circulate the heated liquid to the normal system. If the liquid is water it may be circulated to the domestic water heater to increase the temperature further prior to entering the hot water supply system. There are also collectors that heat air which is then passed through an air to liquid heat exchanger to increase the temperature of another fluid. 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 domestic water preheating. The most common method involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system). The most practical system for the police department building would utilize a solar circulation, domestic hot water system that pre-heats incoming water prior to entering the domestic water heater. Although this type of solar hot water system is both the simplest and least expensive to implement, the daily hot water consumption within the facility is not large enough to provide a reasonable payback on the system. Domestic hot water is presently produced by an electric water heater and, therefore, this system could save site electricity.

Currently, an incentive is not available for installation of thermal solar systems. A Federal tax credit of 30% of installation cost for the thermal applications is available; however, the Township of Andover 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 E and summarized on the following page:

Solar Thermal Domestic Hot Water Plant

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$	$	$	Years	Years
9,300	0	2,400	0	400	400	NA	>25	NA

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

This measure is not recommended.

6.2 Wind

Wind turbines are part of a renewable energy system that converts the kinetic energy of wind into usable mechanical and electrical energy. Small wind turbines comprise the group of turbines utilized for residential and small business applications.

The most common design for small wind turbines utilize a horizontal axis propeller which converts kinetic energy of the wind 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 Andover Township area, the map indicates a mean annual wind speed of less than 4.5 meters per second, approximately 14 miles per hour. Most small wind turbines are not financially viable at such wind speeds. Therefore, the model indicates that a wind turbine installation may not be applicable at this location. The model was designed to provide a good indication of wind speeds at applicable locations throughout the state. Before moving forward with a small wind production project at the facility's location, a wind test tower will need to be installed at the 30 meter tower height and monitored for a year. Consideration must also be given to the effects of the turbine location on the neighbors and local ordinances.

A wind speed map is included in Appendix F.

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

6.3 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 facility does not have sufficient need for electrical generation or the ability to use most of the thermal byproduct during the winter or summer months. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. Purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

This measure is not recommended.

6.4 Biomass Power Generation

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

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

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

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

- Digestion of sewage sludge

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

* from NJOCE Website

This measure is not recommended because of noise issues, potential zoning issues, and the lack of a reliable waste stream that can be utilized.

6.5 Demand Response Curtailment

Presently, electricity is delivered by JCP&L, which receives the electricity from regional power grid RFC. 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.

Utility Curtailment, also known as Economic Load Response, is an agreement with the PJM regional transmission organization and an approved Curtailment Service Provider (CSP) to reduce electrical demand by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and 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 emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

A PJM pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The facility had a monthly average kW demand of 6.8 kW and a maximum demand of 8.9 kW over the previous 12 months.

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

7.0 EPA PORTFOLIO MANAGER

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

The police department facility is considered an average energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 64 kBTU/ft^2/year. In comparison, a site with an energy performance rating of 75 (the minimum to be eligible for ENERGY STAR) has a site EUI of 29 kBTU/ft^2/year and the national average site EUI is 77 kBTU/ft^2/year. Although the building is extremely efficient, the building's EUI is higher than a similarly sized building with an ENERGY STAR rating of 75 because the building has a number of areas that operate around the clock.

If the recommended measure is implemented, ECM-1, the facility's EUI will be reduced from 64 kBTU/ft^2/year to 62 kBTU/ft^2/year.

The EPA Portfolio Manager was not able to calculate an energy performance rating for this building because more than 50% of the floor area is defined as "Other" within the program. Although the Portfolio Manager does not calculate a rating for this building, we are still able to compare the building's performance with a building rated 75 and the national average for all buildings designated "Other" as follows:

Energy Performance Comparison

	Evaluation Period	Comparisons	
Performance Metrics	Baseline (Ending date 11/30/2009)	Rating of 75	National Average
Energy Intensity			
Site (kBtu/ft^2)	64	29	77
Source (kBtu/ft^2)	212	96	182
Energy Cost			
$/year	$19,280.05	$10,222.19	$37,444.51
$/$ft^2$/year	$3.01	$1.59	$4.28
Greenhouse Gas Emissions			
$MtCO_2e$/year	62	28	75
$kgCO_2e/ft^2$/year	10	4	11

A full EPA Energy Star Portfolio Manager Report is located in Appendix G.

The user name and password for the facility's EPA Portfolio Manager Account has been provided to Timothy B. Day, CFO/Treasurer for Andover Township.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Newton, NJ, Andover Township Police Department, in the Township of Andover, New Jersey identified a potential ECM for lighting fixture control modifications. Potential annual savings of $550 may be realized for the recommended ECM, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Lighting Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
1,400	0	3,400	0	550	4.9	300	2.5	2.0

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of fifteen wall-mounted occupancy sensors.

APPENDIX A

Utility Usage Analysis

BPU ENERGY AUDIT PROGRAM

Andover Police Station

CHA Project #20997

Electricity Cost Summary: Meter #G23539365															
Period	Customer Charge	Demand kw	Transmission kWh	Reconciliation kWh	Transitional Assessment kWh	RGGI Recovery kWh	Delivery kWh	Societal Benefits kWh	System Control Charge kWh	Delivery Total	Basic Generation kWh	Non-Utility Generation kWh		Supply Total	Total
January	$ 11.65	$ 135.87	$ 76.40	$ (17.01)	$36.19	-	$ 113.69	$ 79.65	$ 0.98	$ 437.42	$ 1,344.81	$ 209.63		$ 1,554.44	$ 1,991.86
February	$ 11.65	$ 77.74	$ 65.38	$ (13.98)	$ 29.75	-	$ 102.79	$ 65.47	$ 0.80	$ 339.60	$ 1,105.44	$ 172.31		$ 1,277.75	$ 1,617.35
March	$ 11.65	$ 102.87	$ 64.09	$ (47.16)	$ 29.16	-	$ 101.79	$ 64.18	$ 0.79	$ 327.37	$ 1,083.68	$ 168.92		$ 1,252.60	$ 1,579.97
April	$ 11.65	$ 66.36	$ 61.78	$ (50.38)	$ 28.11	-	$ 100.01	$ 61.86	$ 0.76	$ 280.15	$ 1,044.51	$ 162.82		$ 1,207.33	$ 1,487.48
May	$ 11.65	$ 66.36	$ 54.57	$ (44.50)	$ 24.83	$ 0.51	$ 94.46	$ 54.65	$ 0.67	$ 263.20	$ 922.65	$ 143.82		$ 1,066.47	$ 1,329.67
June	$ 11.65	$ 68.01	$ 55.45	$ (41.46)	$ 25.65	$ 0.56	$ 100.47	$ 56.45	$ 0.69	$ 277.47	$ 1,089.21	$ 148.57		$ 1,237.78	$ 1,515.25
July	$ 11.65	$ 75.65	$ 64.45	$ (47.69)	$ 29.87	$ 0.65	$ 107.61	$ 65.73	$ 0.81	$ 308.73	$ 1,264.93	$ 172.99		$ 1,437.92	$ 1,746.65
August	$ 11.65	$ 79.12	$ 63.70	$ (47.12)	$ 29.51	$ 0.65	$ 107.02	$ 64.96	$ 0.80	$ 310.29	$ 1,250.05	$ 170.96		$ 1,421.01	$ 1,731.30
September	$ 11.65	$ 66.36	$ 63.29	$ (92.31)	$ 28.23	$ 0.62	$ 104.84	$ 62.12	$ 0.76	$ 245.56	$ 1,195.49	$ 163.49		$ 1,358.98	$ 1,604.54
October	$ 11.65	$ 66.36	$ 60.99	$ (94.91)	$ 27.05	$ 0.04	$ 98.22	$ 58.88	$ 0.73	$ 229.01	$ 1,040.96	$ 156.71		$ 1,197.67	$ 1,426.68
November	$ 11.65	$ 68.58	$ 69.44	$ (106.14)	$ 30.80	-	$ 104.57	$ 66.51	$ 0.83	$ 246.24	$ 1,185.16	$ 178.42		$ 1,363.58	$ 1,609.82
December	$ 11.65	$ 66.36	$ 68.12	$ (44.17)	$ 30.22	-	$ 103.58	$ 65.24	$ 0.82	$ 301.82	$ 1,162.63	$ 175.03		$ 1,337.66	$ 1,639.48
														$ -	$ -
Totals	$ 139.80	$ 939.64			$ 349.37		$ 1,239.05	$ 765.70	$ 9.44	$ 3,566.86	$ 13,689.52	$ 2,023.67	$ -	$ 15,713.19	$ 19,280.05

JCP&L Rate Schedule "GS Secondary"

BPU ENERGY AUDIT PROGRAM

Andover Police Station

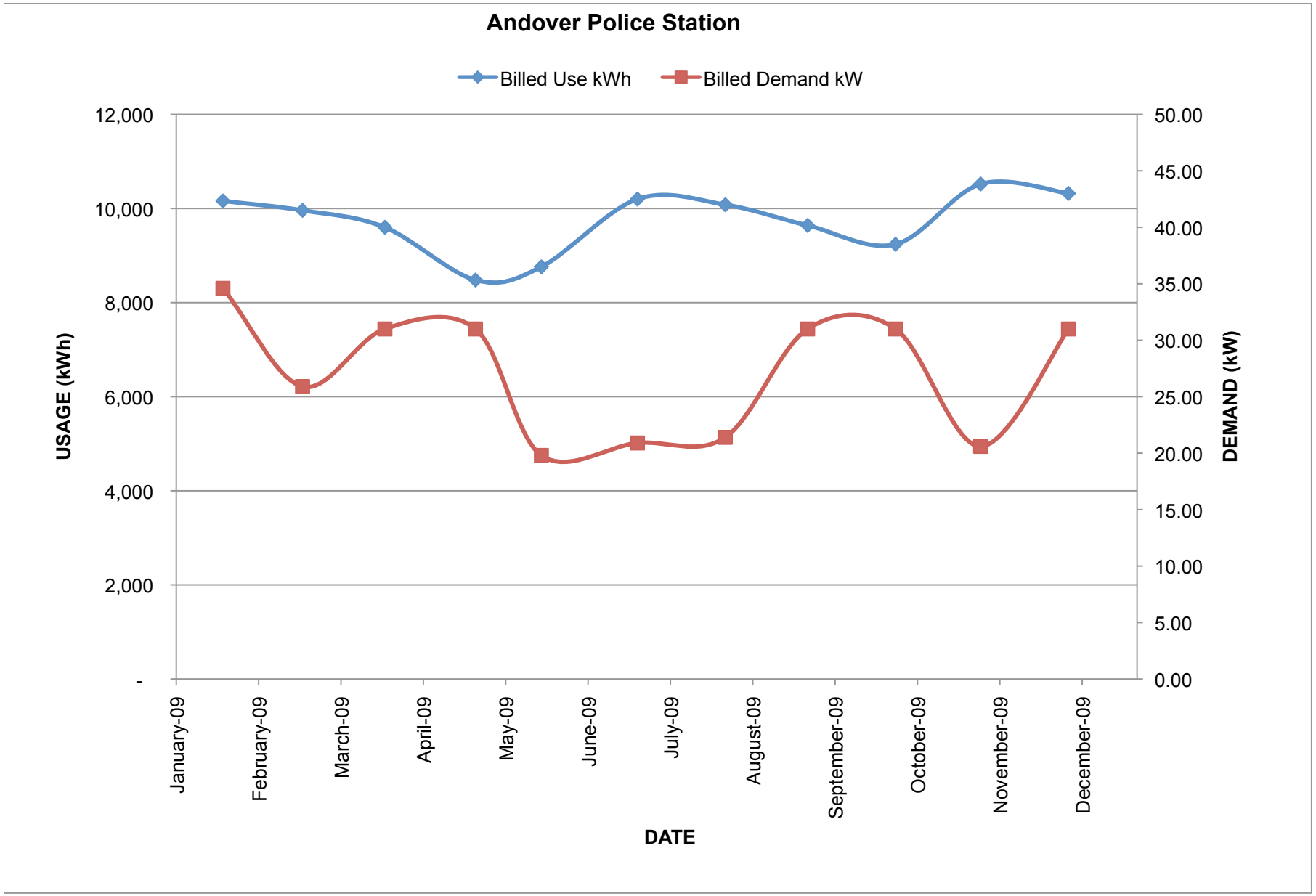
CHA Project #20997

Electricity Cost Summary: Meter #G23539365						
Period	Billed Use kWh	Billed Demand kW	Total Cost $	Demand Unit Cost $/kW	Suppy Unit Cost $/kWh	Blended Cost $/kWh
January-09	12,360	31.00	$ 1,991.86	$ 6.47	$ 0.11	$ 0.1612
February-09	10,160	34.60	$ 1,617.35	$ 3.16	$ 0.11	$ 0.1592
March-09	9,960	25.90	$ 1,579.97	$ 6.47	$ 0.11	$ 0.1586
April-09	9,600	31.00	$ 1,487.48	$ 3.16	$ 0.11	$ 0.1549
May-09	8,480	31.00	$ 1,329.67	$ 3.16	$ 0.11	$ 0.1568
June-09	8,760	19.80	$ 1,515.25	$ 6.94	$ 0.13	$ 0.1730
July-09	10,200	20.90	$ 1,746.65	$ 6.94	$ 0.12	$ 0.1712
August-09	10,080	21.40	$ 1,731.30	$ 6.94	$ 0.12	$ 0.1718
September-09	9,640	31.00	$ 1,604.54	$ 3.16	$ 0.12	$ 0.1664
October-09	9,240	31.00	$ 1,426.68	$ 3.16	$ 0.11	$ 0.1544
November-09	10,520	20.60	$ 1,609.82	$ 6.47	$ 0.11	$ 0.1530
December-09	10,320	31.00	$ 1,639.48	$ 3.16	$ 0.11	$ 0.1589
Totals	119,320	329.20	$ 19,280.05			$ 0.1616
Monthly Ave.	9,943	27.43	$ 1,606.67	$ 4.93	$ 0.12	
Max. Demand		34.60				

Account Number: 10 00 52 9031 90
Meter Number: G23539365
Rate Schedule: GS Secondary
Utility Company: JCP&L

Notes:

Total Billed Use kWh is the sum of each month's use in kWh.
Total Billed Billed Demand is the highest month's demand.
Total Cost is sum of each month's total billing including all charges.
(See Chart 2 "Total Column".)
Demand Unit Cost per month is kW charges from Chart 2 divided by kW used.
Does not include Service Charge from Chart 2.
Supply Unit Cost per month is kWh charges from Chart 2 divided by kWh used.
Does not include Service Charge from Chart 2
Total Demand Unit Cost is total kW charges from chart 2 divided by total kW used.
Total Supply Unit Cost per year total kWh charges from chart 2 divided by total kWh.
Blended Rate per month is the Cost divided by the kWh used for that month.
Total Blended Rate is the Total Cost divided by the Total Use for the year.


Andover Police Station
Billed Use kWh
Billed Demand kW
12,000
10,000
8,000
6,000
4,000
2,000
-
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
USAGE (kWh)
DEMAND (kW)
January-09
February-09
March-09
April-09
May-09
June-09
July-09
August-09
September-09
October-09
November-09
December-09
DATE

Licensed Electric Generation Suppliers

(May 2010)

To sell electric generation service in New Jersey, electric power suppliers must be licensed by the New Jersey Board of Public Utilities (NJ BPU). They must also be registered with the local public utility to sell electric generation service in that utility's service area. Below is a list of suppliers who are licensed with the NJ BPU and are registered to sell electric generation service in the Jersey Central Power & Light Company service territory.

Supplier Name	Phone No.
BOC Energy Services	800-247-2644
Champion Energy Services, Inc.	281-653-5090
Commerce Energy, Inc.	800-556-8457
Con Edison Solutions, Inc.	888-686-1383
Constellation NewEnergy, Inc.	888-635-0827
Direct Energy, LLC	800-260-0300
Dominion Retail, Inc.	800-264-4754
FirstEnergy Solutions Corp.	800-977-0500
Gateway Energy Services Corp.	800-313-8333
Glacial Energy	877-569-2841
Hess Corp	800-437-7872
Integrys Energy Services, Inc.	877-763-9977
Liberty Power Holdings, LLC	866-POWER-99
Palmco Power NJ, LLC	877-726-5862
Pepco Energy Services, Inc.	800-ENERGY-9
PP&L EnergyPlus, LLC	800-281-2000
Sempra Energy Solutions	877-2SEMPRA
South Jersey Energy	800-756-3749
GDF Suez Energy Resources NA	888-644-1014
UGI Energy Services	800-427-8545

Contact the supplier directly to verify whether or not new customers are being accepted.

APPENDIX B

HVAC Equipment List

BPU ENERGY AUDIT PROGRAM

Andover Township Police Department
CHA Project #20997

HVAC Equipment List											
Item	**Quanity**	**Manufacturer**	**Model Number**	**Serial Number**	**Cooling Capacity (MBH/EER)**	**Condition**	**Fuel**	**Input MBH**	**Heating Output MBH/COP**	**Heating EDH kW**	**Comments**
AC-1	1	Versatec	48	-	44.9 / 12.3 & 54.9 / 16.7	Good	Water Source Heat Pump	-	32.9 / 2.9 & 56.2 / 4.2	-	Serves Operational Wing
AC-2	1	Versatec	80	-	77.9 / 13.1 & 83.0 / 14.8	Good	Water Source Heat Pump	-	53.6 / 3.1 & 95.0 / 4.7	-	Serves Administration Wing
EDH-1	1	Indeeco	-	-	-	Good	Electric	-	45	18	Serves Operational Wing
EDH-2	1	Indeeco	-	-	-	Good	Electric	-	60	13	Serves Administration Wing

Notes:
AC-1 Cooling & EER based on 86 °F EWT / 70 °F EWT.
Heating & COP based on 30 °F EWT / 68 °F EWT.
AC-2 Cooling & EER based on 86 °F EWT / 77 °F EWT.
Heating & COP based on 32 °F EWT / 68 °F EWT.

There are 8 self contained standard ceiling exhaust fans serving the restrooms an dutility room.

APPENDIX C

ECM-1
Lighting Control Modifications

BPU ENERGY AUDIT PROGRAM
Andover Township Police Department
CHA Project #20997

ECM-1 Lighting Control Modifications

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Motion Sensor Control								
Areas Indicated	$ 1,400	$ 550	$ -	$ 550	4.9	$ 300	2.5	2.0

BPU ENERGY AUDIT PROGRAM

Andover Township Police Department
CHA Project #20997

Existing Lighting Fixture Schedule										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
101 - Lobby	B1 - 2'x4' Fluorescent Troffer	1	(2) T8, 32W	(1) Electric	62	62	8760	Breaker	543.12	$87.77
101 - Lobby	B2 - 2'x2' Fluorescent Troffer	4	(2) FU 31	(1) Electric	62	248	8760	Switch	2172.48	$351.07
102 - Dispatcher	C2 - 2'x4' Fluorescent Troffer	6	(3) T8, 32W	(2) Electric	109	654	8760	Switch	5729.04	$925.81
103 - Kitchenette	C2 - 2'x4' Fluorescent Troffer	1	(3) T8, 32W	(2) Electric	109	109	8760	Switch	954.84	$154.30
104 - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	2920	Switch	181.04	$29.26
104 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	(1) Electric	48	48	2920	Switch	140.16	$22.65
105 - Garage	D1 - 1'x4' Surface Mounted Fluorescent	5	(2) T8, 32W	(1) Electric	62	310	8760	Switch	2715.60	$438.84
106 - Utility Room	D1 - 1'x4' Surface Mounted Fluorescent	2	(2) T8, 32W	(1) Electric	62	124	365	Switch	45.26	$7.31
107A - Interview Room	D2 - 16"x48" Surface Mounted Fluorescent	2	(4) T8, 32W	(1) Electric	114	228	8760	Switch	1997.28	$322.76
107B - Interview Room	D2 - 16"x48" Surface Mounted Fluorescent	1	(4) T8, 32W	(1) Electric	114	114	8760	Switch	998.64	$161.38
108 - Patrol Room	A1 - 2'x4' Fluorescent Troffer	9	(3) T8, 32W	(1) Electric	85	765	8760	Switch	6701.40	$1,082.95
108 - Patrol Room	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	8760	Switch	543.12	$87.77
109 - Toilet	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	(1) Electric	85	170	2920	Switch	496.40	$80.22
109 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	(1) Electric	48	48	2920	Switch	140.16	$22.65
110 - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	2920	Switch	181.04	$29.26
110 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	(1) Electric	48	48	2920	Switch	140.16	$22.65
111 - Corridor	B1 - 2'x4' Fluorescent Troffer	5	(2) T8, 32W	(1) Electric	62	310	8760	Switch	2715.60	$438.84
111 - Corridor	B2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	8760	Switch	543.12	$87.77
112 - Corridor	B1 - 2'x4' Fluorescent Troffer	6	(2) T8, 32W	(1) Electric	62	372	8760	Switch	3258.72	$526.61
113 - Copier Room	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	(1) Electric	85	170	2920	Switch	496.40	$80.22
114 - Computer Server	A1 - 2'x4' Fluorescent Troffer	1	(3) T8, 32W	(1) Electric	85	85	52	Switch	4.42	$0.71
115 - Records	C1 - 2'x4' Fluorescent Troffer	6	(3) T8, 32W	(1) Electric	85	510	2920	Switch	1489.20	$240.65
116 - Chief's Office	C1 - 2'x4' Fluorescent Troffer	5	(3) T8, 32W	(1) Electric	85	425	2920	Switch	1241.00	$200.55
116A - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	1460	Switch	90.52	$14.63
116A - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	(1) Electric	48	48	1460	Switch	70.08	$11.32
117 - Conference Room	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	(1) Electric	85	340	2190	Switch	744.60	$120.33
118 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	(1) Electric	85	255	2920	Switch	744.60	$120.33
119 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	(1) Electric	85	255	2920	Switch	744.60	$120.33
120 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	(1) Electric	85	255	2920	Switch	744.60	$120.33
121 - Records	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	(1) Electric	85	255	2920	Switch	744.60	$120.33
122 - Files	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	(1) Electric	85	255	2920	Switch	744.60	$120.33
123 - Janitor Clos	D1 - 1'x4' Surface Mounted Fluorescent	1	(2) T8, 32W	(1) Electric	62	62	365	Switch	22.63	$3.66
124 - Men's Lockers	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	(1) Electric	85	340	2920	Switch	992.80	$160.44
124B - Toilet	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	(1) Electric	85	170	1460	Switch	248.20	$40.11
124B - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	(1) Electric	48	48	1460	Switch	70.08	$11.32
126 - Future Women's Locker	D1 - 1'x4' Surface Mounted Fluorescent	1	(2) T8, 32W	(1) Electric	62	62	52	Switch	3.22	$0.52
127A - Evidence	D3 - 1'x2' Surface Mounted Fluorescent	1	(2) T8, 17W	(1) Electric	33	33	2920	Switch	96.36	$15.57
127B - Evidence	D2 - 16"x48" Surface Mounted Fluorescent	2	(4) T8, 32W	(1) Electric	114	228	2920	Switch	665.76	$107.59
127C - Armor	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	(1) Electric	62	62	730	Switch	45.26	$7.31
128 - Hall	B1 - 2'x4' Fluorescent Troffer	2	(2) T8, 32W	(1) Electric	62	124	8760	Switch	1086.24	$175.54
129 - Kitchenette	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	(1) Electric	85	340	8760	Switch	2978.40	$481.31
Building Exterior	E - Recessed Exterior Downlight, Metal Halide	6	70W MH	(1) Electric	86	516	4380	Photocell	2260.08	$365.23
Building Exterior	F - Wall Mounted Exterior Luminaire, Metal Halide	3	175W MH	(1) Magnetic	205	615	4380	Photocell	2693.70	$435.30
Building Exterior	G - Eave Mounted Floodlight, Metal Halide	2	175W MH	(1) Magnetic	205	410	4380	Photocell	1795.80	$290.20
Flag Pole Light		1				0	4380	Photocell	0.00	$0.00
Parking Area Pole Light	Pole Mounted Light, Metal Halide	4	250W MH	(1) Magnetic	295	1180	4380	Photocell	5168.40	$835.21
Exit Sign	EXIT SIGN - Illuminated LED Exit Sign	5	LED		0.62	3.1	8760	Breaker	27.16	$4.39
						0			0.00	$0.00
						0			0.00	$0.00
TOTAL									**56210.49**	**$9,083.62**

Energy Cost: $0.1616

Notes: **Existing Lighting Fixture Schedule**
Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM
Andover Township Police Department
CHA Project #20997

ECM-1 Lighting Control Modifications

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
Motion Sensor (Wall Mounted)	1	ea	25	50		25	61	-	85	20	

Subtotal	85
10% Contingency	9
10% OH	9
10% Profit	10
Total	113
Incentive	20
Total Cost with Incentive	93

BPU ENERGY AUDIT PROGRAM

Andover Township Police Department
CHA Project #20997

Existing Lighting Fixture Controls									**Prooposed Lighting Fixture Controls**					**Savings After Retrofit**	
Location	Fixture Description	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings/Year	Payback in Years
101 - Lobby	B1 - 2'x4' Fluorescent Troffer	1	(2) T8, 32W	62	8760	Breaker	543	$87.77							
101 - Lobby	B2 - 2'x2' Fluorescent Troffer	4	(2) FU 31	248	8760	Switch	2172	$351.07							
102 - Dispatcher	C2 - 2'x4' Fluorescent Troffer	6	(3) T8, 32W	654	8760	Switch	5729	$925.81							
103 - Kitchenette	C2 - 2'x4' Fluorescent Troffer	1	(3) T8, 32W	109	8760	Switch	955	$154.30							
104 - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	2920	Switch	181	$29.26	Motion Sensor	2190	136	$21.94	$93.14	$7.31	12.7
104 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	48	2920	Switch	140	$22.65	Motion Sensor	2190	105	$16.99	$93.14	$5.66	16.4
105 - Garage	D1 - 1'x4' Surface Mounted Fluorescent	5	(2) T8, 32W	310	8760	Switch	2716	$438.84							
106 - Utility Room	D1 - 1'x4' Surface Mounted Fluorescent	2	(2) T8, 32W	124	365	Switch	45	$7.31	Motion Sensor	273.75	34	$5.49	$93.14	$1.83	50.9
107A - Interview Room	D2 - 16"x48" Surface Mounted Fluorescent	2	(4) T8, 32W	228	8760	Switch	1997	$322.76							
107B - Interview Room	D2 - 16"x48" Surface Mounted Fluorescent	1	(4) T8, 32W	114	8760	Switch	999	$161.38							
108 - Patrol Room	A1 - 2'x4' Fluorescent Troffer	9	(3) T8, 32W	765	8760	Switch	6701	$1,082.95							
108 - Patrol Room	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	8760	Switch	543	$87.77							
109 - Toilet	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	170	2920	Switch	496	$80.22	Motion Sensor	2190	372	$60.16	$46.57	$20.05	2.3
109 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	48	2920	Switch	140	$22.65	Motion Sensor	2190	105	$16.99	$46.57	$5.66	8.2
110 - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	2920	Switch	181	$29.26	Motion Sensor	2190	136	$21.94	$46.57	$7.31	6.4
110 - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	48	2920	Switch	140	$22.65	Motion Sensor	2190	105	$16.99	$46.57	$5.66	8.2
111 - Corridor	B1 - 2'x4' Fluorescent Troffer	5	(2) T8, 32W	310	8760	Switch	2716	$438.84							
111 - Corridor	B2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	8760	Switch	543	$87.77							
112 - Corridor	B1 - 2'x4' Fluorescent Troffer	6	(2) T8, 32W	372	8760	Switch	3259	$526.61							
113 - Copier Room	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	170	2920	Switch	496	$80.22	Motion Sensor	2190	372	$60.16	$93.14	$20.05	4.6
114 - Computer Server	A1 - 2'x4' Fluorescent Troffer	1	(3) T8, 32W	85	52	Switch	4	$0.71	Motion Sensor	39	3	$0.54	$93.14	$0.18	521.6
115 - Records	C1 - 2'x4' Fluorescent Troffer	6	(3) T8, 32W	510	2920	Switch	1489	$240.65	Motion Sensor	2190	1117	$180.49	$93.14	$60.16	1.5
116 - Chief's Office	C1 - 2'x4' Fluorescent Troffer	5	(3) T8, 32W	425	2920	Switch	1241	$200.55	Motion Sensor	2190	931	$150.41	$93.14	$50.14	1.9
116A - Toilet	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	1460	Switch	91	$14.63	Motion Sensor	1095	68	$10.97	$45.57	$3.66	12.5
116A - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	48	1460	Switch	70	$11.32	Motion Sensor	1095	53	$8.49	$45.57	$2.83	16.1
117 - Conference Room	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	340	2190	Switch	745	$120.33	Motion Sensor	1642.5	558	$90.25	$93.14	$30.08	3.1
118 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	255	2920	Switch	745	$120.33	Motion Sensor	2190	558	$90.25	$93.14	$30.08	3.1
119 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	255	2920	Switch	745	$120.33	Motion Sensor	2190	558	$90.25	$93.14	$30.08	3.1
120 - Office	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	255	2920	Switch	745	$120.33	Motion Sensor	2190	558	$90.25	$93.14	$30.08	3.1
121 - Records	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	255	2920	Switch	745	$120.33	Motion Sensor	2190	558	$90.25	$93.14	$30.08	3.1
122 - Files	A1 - 2'x4' Fluorescent Troffer	3	(3) T8, 32W	255	2920	Switch	745	$120.33	Motion Sensor	2190	558	$90.25	$93.14	$30.08	3.1
123 - Janitor Clos	D1 - 1'x4' Surface Mounted Fluorescent	1	(2) T8, 32W	62	365	Switch	23	$3.66	Motion Sensor	273.75	17	$2.74	$93.14	$0.91	101.9
124 - Men's Lockers	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	340	2920	Switch	993	$160.44	Motion Sensor	2190	745	$120.33	$93.14	$40.11	2.3
124B - Toilet	A1 - 2'x4' Fluorescent Troffer	2	(3) T8, 32W	170	1460	Switch	248	$40.11	Motion Sensor	1095	186	$30.08	$45.57	$10.03	4.5
124B - Toilet	H - 3' Wall Mounted Fluorescent	1	(2) T8, 25W	48	1460	Switch	70	$11.32	Motion Sensor	1095	53	$8.49	$45.57	$2.83	16.1
126 - Future Women's Locker	D1 - 1'x4' Surface Mounted Fluorescent	1	(2) T8, 32W	62	52	Switch	3	$0.52							
127A - Evidence	D3 - 1'x2' Surface Mounted Fluorescent	1	(2) T8, 17W	33	2920	Switch	96	$15.57	Motion Sensor	2190	72	$11.68	$45.57	$3.89	11.7
127B - Evidence	D2 - 16"x48" Surface Mounted Fluorescent	2	(4) T8, 32W	221	2920	Switch	645	$104.28	Motion Sensor	2190	484	$78.21	$45.57	$26.07	1.7
127C - Armor	A2 - 2'x2' Fluorescent Troffer	1	(2) FU 31	62	730	Switch	45	$7.31	Motion Sensor	547.5	34	$5.49	$93.14	$1.83	50.9
128 - Hall	B1 - 2'x4' Fluorescent Troffer	2	(2) T8, 32W	124	8760	Switch	1086	$175.54							
129 - Kitchenette	A1 - 2'x4' Fluorescent Troffer	4	(3) T8, 32W	340	8760	Switch	2978	$481.31	Motion Sensor	6570	2234	$360.98	$93.14	$120.33	0.8
Building Exterior	E - Recessed Exterior Downlight, Metal Halide	6	70W MH	516	4380	Photocell	2260	$365.23							
Building Exterior	F - Wall Mounted Exterior Luminaire, Metal Halide	3	175W MH	615	4380	Photocell	2694	$435.30							
Building Exterior	G - Eave Mounted Floodlight, Metal Halide	2	175W MH	410	4380	Photocell	1796	$290.20							
Flag Pole Light		1			4380	Photocell	0	$0.00							
Parking Area Pole Light	Pole Mounted Light, Metal Halide	4	250W MH	1180	4380	Photocell	5168	$835.21							
Exit Sign	EXIT SIGN - Illuminated LED Exit Sign	5	LED	3.1	8760	Breaker	27	$4.39							

Energy Cost: $0.1616

*Installation costs do not include potential incentive.

Notes:
Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost

Lighting Control Modifications

Motions Sensors with 10 Years or Less Payback

kwh Savings/Year	Installation Cost	Cost Savings/Year	Payback in Years
3421	$1,393.10	$552.80	2.5

APPENDIX D

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts ***** AC Energy & Cost Savings ***** Cautions for Interpreting the Results

(Type comments here to appear on printout; maximum 1 row of 90 characters.)

Station Identification	
Cell ID:	0267369
State:	New Jersey
Latitude:	41.3 ° N
Longitude:	74.7 ° W
PV System Specifications	
DC Rating:	30.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	23.1 kW
Array Type:	Fixed Tilt
Array Tilt:	41.3 °
Array Azimuth:	180.0 °
Energy Specifications	
Cost of Electricity:	16.2 ¢/kWh

Results

Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	2.90	2152	347.76
2	3.77	2486	401.74
3	4.69	3339	539.58
4	4.72	3149	508.88
5	5.14	3394	548.47
6	5.26	3282	530.37
7	5.23	3296	532.63
8	5.05	3223	520.84
9	4.64	2940	475.10
10	4.04	2741	442.95
11	2.73	1798	290.56
12	2.41	1710	276.34
Year	4.22	33512	5415.54

Output Results as Text

SAVING TEXT FROM A BROWSER

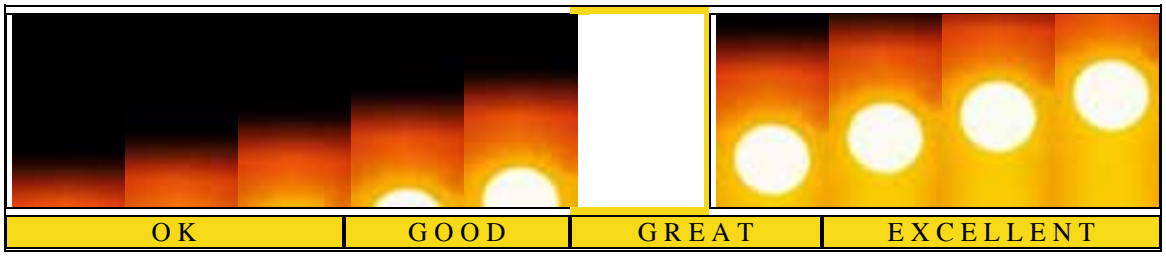
RUN PVWATTS V.2 FOR ANOTHER LOCATION

RUN PVWATTS V.1

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

Your Solar Electric Estimate

YOUR SOLAR RATING



The solar rating of your area is **Great** for adopting a solar system. (4.68 kWh/m^2 per day).
You may want to change some of the information to better match your situation.

Customize Your Assumptions

Price Installed $ 8 per watt DC.
This is a user-entered cost. Enter 0 to return to default.

Provide 32 % of my electricity, on average, over the course of a year.

Electric Rate: $	0.1616/kWh More
Monthly Electric Usage:	9,943kWh/Month More
Utility Annual Inflation Rate:	3.78%
Utility Savings Method:	Net Metering (common)
Federal ITC Based Upon:	Gross Cost
Federal Income Tax Rate:	28%
State Income Tax Rate:	7.8% (Low: 1.40% - High: 8.97%) help

Loan Modeling: Borrow 0 % of $145,200 estimated cost
at 6.5 % interest (apr) re-paid over 30 years

---

f you agree **this is a smart investment**, we encourage
ou to work with a Professional to help you install your
ery own system.

http://www.solar-estimate.org/index.php?page=solar-installer&subpage=show&wantsolar=1&zipcode=07860

lick on the buttons to learn about our assumptions and other important information used to generate your estimate. Also, please review the
otes below.

lelp us improve. We rely on feedback from our users to help keep our service accurate and useful:
› Send us your Feedback

Your Solar Electric Estimate by the Numbers

Building Type:	Commercial/Business
State & County:	NJ - Sussex
Utility:	Jersey Central Power & Lt Co

Utility Type:	Investor-Owned Utility
Your Average Monthly Electricity Bill: (Assumed rate x average monthly useage)	$ 1,607 / Month
Tiered Rates Apply:	No
Time-of-Use Metering Offered:	No
Net-Metering Available:	Yes - See Notes, below!

ESTIMATED SYSTEM SIZE

The system size best for your situation will vary based upon product, building, geographic and other variables. We encourage you to work with a Solar Pro who can better estimate the system size best for your situation. We estimate your building will need a system sized between 24.20 kW and 36.30 kW of peak power. This estimate assumes the mid-point of this range.

Solar Rating:	**Good** 4.68 kWh/sq-m/day
Solar System Capacity Required:	30.25 kW of peak power (DC watts)
Roof Area Needed:	3,025 sq-ft
Equivalent Annual Production:	38,176 kWh electricity

ESTIMATED SYSTEM COST

This is only an estimate based upon many assumptions. Installation costs can vary considerably. We encourage you to work with a Solar Pro who can provide you with a more detailed cost estimate. We estimate that a 30 kW peak DC power system will cost between $193,600 and $290,400. This estimate assumes the mid-point of this cost range.

Assumed Installation Gross Cost: "Gross Cost" is the cost before any rebates, incentives, tax credits, etc. are applied. See the Cost Notes, below!	**$242,000** assuming $8 per watt DC

FINANCIAL INCENTIVES

Financial incentives shown are totals across all years. So, if an incentive spans multiple years then the value shown is the total of all years. For details, please refer to the table below "Cash Flow by Year and Cumulative Across Years"

NJ: Solar Renewable Energy Certificates (SREC) » link	$ 294,036
NJ Solar Electric (PV) Incentive (Non-residential $ 0.80 per watt to 50 kW) » link	$ 24,200

Federal Tax Credit (30% of Gross Cost at Installation) » link	$ 72,600
Modified Accelerated Cost Recovery System (MACRS) Depreciation (5 yr) » link	**YES**
ESTIMATED NET COST:	**$ -148,836**
ESTIMATED NET COST AT INSTALLATION:	**$ 145,200**
Cash & Loan Amounts:	$ 145,200 Cash $ 0 Borrowed
Loan Monthly Payment (6.5% apr, 30 years):	$ 0

CASH FLOW

Cash Flow Breakeven is where the chart crosses the $ zero point - this is when your investment has paid itself back in cash.

The chart above is a summary of the net cash flow you can expect over time. Net Cash Flow is the total cash after all costs (out-flows of cash) are reduced by financial incentives, annual utility savings and tax effects (in-flows of cash).

Average values are used together with your assumed income tax rate (36%). Any property appreciation has not been included, as this is generally not a cash flow (it's an investment). The loan modeled, if any, is included. Because this is a business, we have assumed utility savings result in loss of some expense write offs against income, but Modified Accelerated Cost Recovery System (MACRS) Depreciation applies (an income tax benefit). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income.

SAVINGS & BENEFITS

First-year Utility Savings:	**$6,170**
Average Monthly Utility Savings: *over 25-year expected life of system*	**$863**
Average Annual Utility Savings: *over 25-year expected life of system*	**$10,356**
25-year Utility Savings:	**$258,900**
Return on Investment (ROI):	**243%**
Internal Rate of Return (IRR):	**23.6%**
Net Present Value (NPV):	**$192,994**
Profitability Index:	**2.3**
Greenhouse Gas (CO2) Saved: *over 25-year system life*	**783 tons** **1,566,000 auto miles**

Cash Flow by Year and Cumulative Across Years

This cash flow table includes tax effects applied to utility savings and loan interest payments (if any). For commercial (business) situations we assume utility savings result in loss of some expense write offs against income: Utility Savings = ($'s saved on utility bill) x (1 - Income Tax Rate). "Tax Savings from MACRS

depreciation" (below) is the net cash saved on income taxes after the depreciation expense is written off. So the amount that was depreciated would be the cash value shown divided by the Income Tax Rate (more info.). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income. Any income from your system (e.g. performance-based incentives and "SREC's") may be taxed as income (also not shown).

Year of Operation:	**at Install**	**1**	**2**	**3**	**4**	**5**
Gross Cost	($242,000)					
NJ: Solar Renewable Energy Certificates (SREC)	$0	$24,068	$23,343	$22,641	$21,959	$21,298
NJ Solar Electric (PV) Incentive (Non-residential $ 0.80 per watt to 50 kW)	$24,200	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$72,600	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$0	$12,995	$20,793	$12,476	$7,485	$7,485
Utility Savings	$0	$4,111	$4,266	$4,427	$4,595	$4,769
ANNUAL CASH FLOW	$-145,200	$41,174	$48,402	$39,544	$34,039	$33,552
Cumulative Cash Flow	$-145,200	$-104,026	$-55,624	$-16,080	$**17,959** **Breakeven**	$51,511

Year of Operation:	**6**	**7**	**8**	**9**	**10**	**11**
Gross Cost						
NJ: Solar Renewable Energy Certificates (SREC)	$20,657	$20,036	$19,433	$18,848	$18,280	$17,730
NJ Solar Electric (PV) Incentive (Non-residential $ 0.80 per watt to 50 kW)	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$0	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$3,743	$0	$0	$0	$0	$0
Utility Savings	$4,949	$5,136	$5,330	$5,531	$5,741	$5,958
ANNUAL CASH FLOW	$29,348	$25,172	$24,763	$24,379	$24,021	$23,688
Cumulative Cash Flow	$80,859	$106,031	$130,794	$155,173	$179,194	$202,882

Year of Operation:	**12**	**13**	**14**	**15**	**16**	**17**
Gross Cost				($27,225) Inverter Replaced		
NJ: Solar Renewable Energy Certificates (SREC)	$17,197	$16,679	$16,177	$15,690	$0	$0
NJ Solar Electric (PV) Incentive (Non-residential $ 0.80 per watt to 50 kW)	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross	$0	$0	$0	$0	$0	$0

Cost at Installation)						
Tax savings from MACRS Depreciation	$0	$0	$0	$0	$0	$0
Utility Savings	$6,183	$6,416	$6,659	$6,911	$7,172	$7,443
ANNUAL CASH FLOW	$23,380	$23,095	$22,836	$-4,624	$7,172	$7,443
Cumulative Cash Flow	$226,262	$249,357	$272,193	$267,569	$274,741	$282,184

Year of Operation:	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gross Cost								
NJ: Solar Renewable Energy Certificates (SREC)	$0	$0	$0	$0	$0	$0	$0	$0
NJ Solar Electric (PV) Incentive (Non-residential $ 0.80 per watt to 50 kW)	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$0	$0	$0	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$0	$0	$0	$0	$0	$0	$0	$0
Utility Savings	$7,724	$8,016	$8,319	$8,634	$8,960	$9,299	$9,650	$10,015
ANNUAL CASH FLOW	$7,724	$8,016	$8,319	$8,634	$8,960	$9,299	$9,650	$10,015
Cumulative Cash Flow	$289,908	$297,924	$306,243	$314,877	$323,837	$333,136	$342,786	$352,801

FAQ's: Frequently Asked Questions for NJ:

- Are renewable energy systems exempt from sales tax in New Jersey?
- Can I sell Solar Renewable Energy Certificates (SREC) in New Jersey?
- Where can I find more information about New Jersey Renewable energy programs and incentives?

Notes & Assumptions: Solar Electric (PV) Systems

* HOW TO REDUCE THE SYSTEM SIZE NEEDED & INCREASE SAVINGS

The estimate provided above assumes "base" electric rates apply. Other taxes and surcharges may be applied to your utility bill. We suggest you review a recent utility bill and change the "Assumed Electric Rate", above, as needed to better match your situation.

You may have other metered-rate options with your utility. Options such as Tiered billing rates, Time-Of-Use (TOU) metering, and Net-Metering, if available, can help reduce the system size you need to provide a "net-zero" energy bill. Sometimes people also reduce the size of their solar system to accommodate planned

improvements in their building's energy efficiency, or to match a budget and/or the available space for installing a solar system.
Energy production from a solar electric (PV) system is a function of several factors, including the following. Our assumptions are:

Factor	Assumption
Solar resources	Assumed solar availability: As per Solar Radiance chart
Soiling or contamination of the PV panels	Clean, washed frequently: 100% design sunlight transmission
Temperature	25C, calm wind
System configuration (battery or non-battery)	Non-battery
Orientation to the sun	tilted at your latitude, full sun
Shading	None
PV Energy delivered as % of manufacturer's rating	95%
Soiling, wiring & power point tracking losses	9% (91% delivered)
Inverter Efficiency	90%
Total Energy Delivered	95% x 91% x 90% = 78%

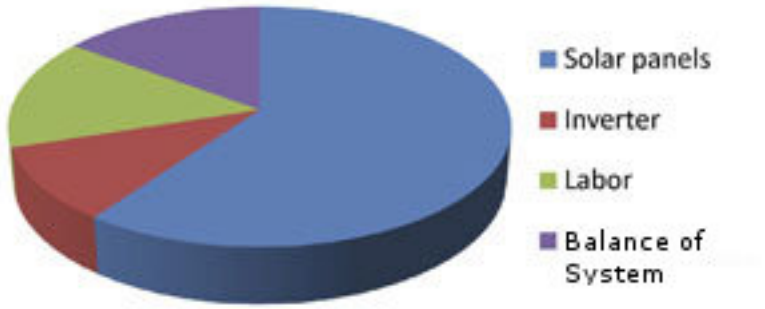
Energy Efficiency: Improving your building's energy efficiency will reduce the system size you need to attain a "net-zero" energy bill.
Tiered Rates: Often people are paying a "Tiered" rate for their electricity. This is a higher rate (higher than the "Base" rate) for electricity charged when a home or building uses more that a "Base" amount allocated for the building. Installing a solar system will reduce your electrical demand from the utility. This can result in a lower utility rate because you stay within the "Base" rate level. In this case, the more expensive "Tiered" rate electricity is eliminated, reducing your average electricity rate.
TOU Metering: Many utilities offer Time-of-Use (TOU) meters. This allows the price of electricity to vary by time of day (called "Peak" or "Off-Peak" periods) and by season (usually "Winter" versus "Summer" rates). If TOU metering is offered by your utility, a solar system may result in additional savings. This is because peak (more expensive electricity) rates often occur during the daytime. This is usually when a solar system is producing the most output, thus reducing your demand for peak-rate electricity from the utility.
Most utilities do charge for the purchase and installation of a time-of-use meter (normally a few hundred dollars). We have assumed the cost for this is part of the "Estimated Installation cost" shown above.
Net-Metering: With Net-Metering, surplus electricity generated by your renewable energy system will be credited back to your utility account. So if your solar system makes more electricity than you are using, the "meter spins backwards". You are not actually "selling" electricity, since in most states the utility will not reimburse you for excess electricity. But, if your utility offers "Net-Metering" you may be able to get credit for electricity provided back to the grid during peak periods. Combined with TOU metering, Net-Metering can result in multiplied savings since your electricity account may be gaining electricity credits during the time of peak utility rates -- Think of a hot, sunny summer day ... your solar system is producing power, spinning your electric meter backwards, and supplying the grid with electricity to run other people's air conditioners -- you're "spinning back" cost at peak rates! That's the savings power of Net-metering, combined with TOU rates.

Solar Power "Fixes" Energy Costs: The cost of sunshine is free. While the sun rises every morning, the cost of sunshine does not. Utility rates, on the other hand, tend to rise steadily in cost. So, the value of your savings from a solar system are likely to increase as time goes on. If you are on a fixed income (e.g. nearing or in retirement) this may be of particular interest to you.

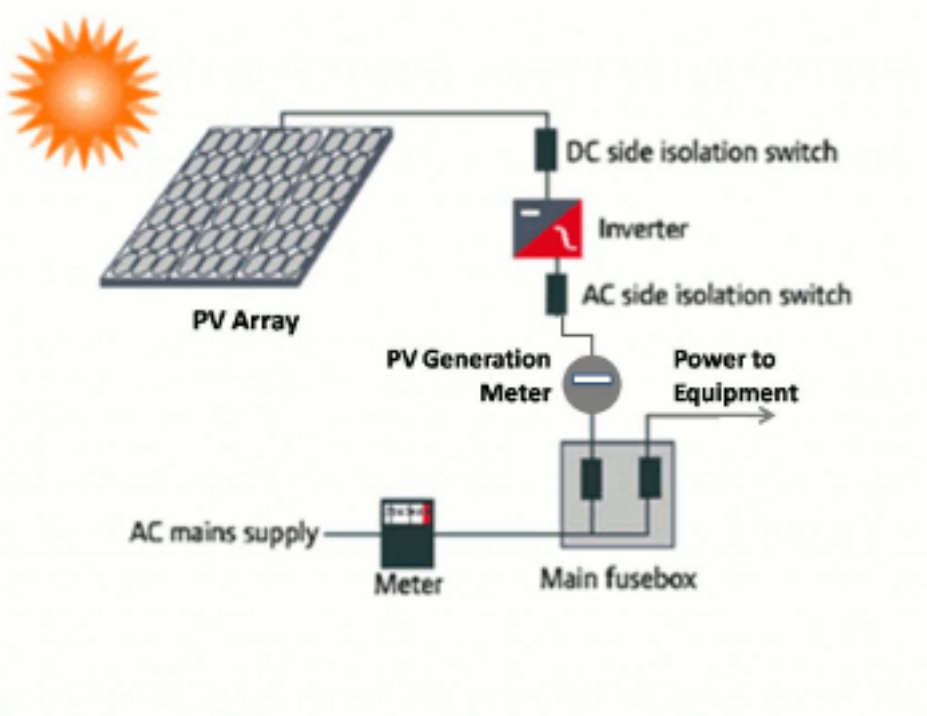
THE COST TO GO SOLAR

This is only an estimate based upon many assumptions and limited data entered by you: Installation costs can vary considerably. The cost to purchase and install a complete grid-tied solar photovoltaic (PV) system on a residential home is typically as further defined in the table, below. This includes the PV array, inverter and associated balance of system costs. It does not include the cost of options you may select, such as battery backup power storage, or the costs of building preparation work, like new shingles. Costs can also be higher if you add other features or have special installation needs (such as application over tile roofing) or you choose to use special mounting systems (such as sun tracking systems). Other factors may also affect price, including, but not limited to, your location, the building condition, type and location, its wiring, and warrantees offered.

	Assumed Cost, per Watt DC	
Item	**System Size < 2kW**	**System Size ≥ 2kW**
Assumed Total	$10 per watt DC (+/- 20%)	$9 per watt DC (+/- 20%)



About 60% of the cost to install a solar-electric (PV) system goes to the solar photovoltaic (PV) panels, 10% to an inverter, 15% to direct labor, and 15% to the "balance of system" (BOS) costs.



OTHER ASSUMPTIONS

This summary is based upon many assumptions and the limited data you entered. An actual site assessment by a qualified solar system retailer or contractor will be needed to determine the actual costs and benefits of installing a solar electric system.

HELPFUL PDF's & Links

Report on Solar-Estimate.org Estimator: Comparisons, Methods & Assumptions

Payback & Other Financial Test for Solar on Your Home

The Dept. of Energy's: **PVWatts Online PV Calculator**

Natural Resources Canada's: **RETScreen Renewable Energy Calculators**

A Free Public Service of the Solar & Wind Communities since 2000

Your privacy is important. We will not release or disclose your personal information to others without your permission. Privacy Policy

SOLAR-ESTIMATE.ORG is a free, public service. We believe the efficient use of energy and renewable energy systems makes for comfortable living and a more secure future. So we want to help you reduce your energy demands, increase your energy efficiency and help you utilize more energy from renewable energy systems and sources -- like solar electric (PV - photovoltaics), solar space (air), water & pool heating, wind turbines, biomass furnaces and ground-source heat pumps. Our mission is to serve as a convenient, user-friendly means for home and small commercial building owners to make preliminary evaluations of renewable and solar energy options for their location, run financial analysis and help find and verify the experience, quality and business status of certified solar contractors, and other professionals who can design, install and service renewable and solar energy and energy efficient power systems. (See How It Works). As a business verification service, we maintain the largest directory of current local solar installer and solar contractor profiles including extensive customer reviews and ratings of these professionals. Profiles are not limited to solar energy professionals, but include many other renewable energy, design, engineering and support professional services. We also serve as a consolidator of national and region-specific solar and energy efficiency programs, and utility information about renewable energy, solar energy and energy efficient measures. Our software tools and content include: Online solar estimator (solar calculator, analysis) to help you determine the costs and benefits of a renewable or solar energy system for your particular location and building needs, including financial analysis tools. We also provide a trusted means by which you, as a consumer, can review and access solar panel installers, solar contractors, solar pros and other solar, renewable energy and energy efficiency professional services. And we offer answers to frequently asked questions about renewable and solar power, links and resources to current information about solar power, solar energy, renewable energy, energy bill savings, energy efficiency data, solar incentives, tax credits, rebates and other programs and helpful information so you can learn about solar energy, help us promote renewable and solar power adoption and, hopefully, install a solar system for your home, building, company or community and/or improve your energy efficiency and use. **Site Map**

A solar-powered site and service of Energy Matters LLC.

APPENDIX E

Solar Thermal Domestic Hot Water Plant

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

Interactive Energy Calculators

Our calculators help you understand energy production and consumption in a whole new way. Use them to develop a personal profile of your own energy use.

Solar Water Heating Calculator

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)	2.27	? Water Inlet Temperature (Degrees F)	50
? Capacity (gallons)	40	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	17.52	? Hot Water Temperature (Degrees F)	140
? Effective R-value	19	? Hot Water Usage (Gallons per Day)	40
Energy Use			
1232		? Heat Delivered in Hot Water (BTU/hr)	
64.55		? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		**Electric**
0	? Overall Efficiency	0.9312
0	? Conversion Efficiency	0.98

NaN BTU/hr	? Power Into Water Heater	1323 BTU/hr
Cost		
$ 0.40 /Therm	? Utility Rates	$ 0.1616 /kWh
$ NaN	? Yearly Water Heating Cost	$ 548.513
How Does Solar Compare?		
? Solar Water Heater Cost: $ 9305		? Percentage Solar: 70
NaN years for gas	? Payback Time for Solar System	24.2343 years for electric

More information on solar water heating:

Fact sheet - Solar Water Heaters
Fact sheet - Solar Water Heaters for Swimming Pools
Kids fact sheet - Heat from the Sun

Return to Top of Page

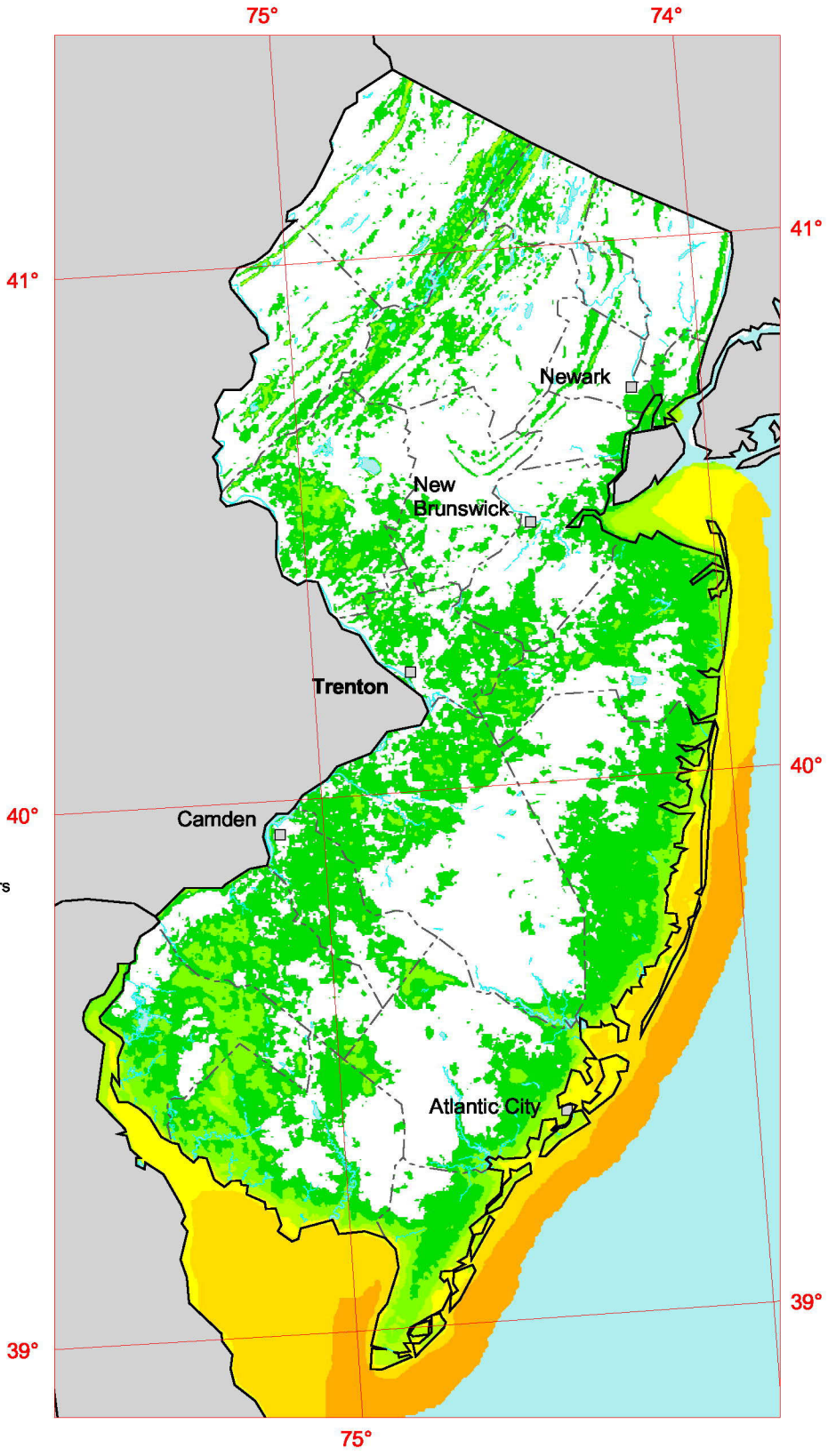
APPENDIX F

Wind

New Jersey

30 m Wind Speed Map

The annual wind speed estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.



15 0 15 30 45 Kilometers

10 0 10 20 30 Miles

Wind Speed at 30 Meters
m/s

- < 4.5
- 4.5 - 5.0
- 5.0 - 5.5
- 5.5 - 6.0
- 6.0 - 6.5
- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 - 8.0
- 8.0 - 8.5
- > 8.5

U.S. Department of Energy
National Renewable Energy Laboratory

NREL

10-JAN-2003 1.1.8

APPENDIX G

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Andover Township Police Station

Building ID: 2272172
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: May 21, 2010

Facility
Andover Township Police Station
134 Newton Sparta Rd
Newton, NJ 07860

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 2003
Gross Floor Area (ft²): 6,400

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	407,120
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	407,120

Energy Intensity[5]

Site (kBtu/ft²/yr)	64
Source (kBtu/ft²/yr)	212

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	62

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	17%
Building Type	Office

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Building Name	Andover Township Police Station	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	134 Newton Sparta Rd, Newton, NJ 07860	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		☐
Office Space (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	
Gross Floor Area	4,000 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	10	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	10	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/911 Wing (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	

Gross Floor Area	2,400 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	N/A(Optional)	Is this the number of personal computers in the space?		
Weekly operating hours	168Hours(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	N/A(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 (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2009	12/31/2009	10,320.00
11/01/2009	11/30/2009	10,520.00
10/01/2009	10/31/2009	9,240.00
09/01/2009	09/30/2009	9,640.00
08/01/2009	08/31/2009	10,080.00
07/01/2009	07/31/2009	10,200.00
06/01/2009	06/30/2009	8,760.00
05/01/2009	05/31/2009	8,480.00
04/01/2009	04/30/2009	9,600.00
03/01/2009	03/31/2009	9,960.00
02/01/2009	02/28/2009	10,160.00
01/01/2009	01/31/2009	12,360.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**119,320.00**
Electric Meter Consumption (kBtu (thousand Btu))		**407,119.84**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**407,119.84**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Andover Township Police Station
134 Newton Sparta Rd
Newton, NJ 07860

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Andover Township Police Station	
Gross Floor Area Excluding Parking: (ft^2)	6,400
Year Built	2003
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

Office Space	
Space Type	Office
Gross Floor Area(ft^2)	4,000
Weekly operating hours	40
Workers on Main Shift	10
Number of PCs	10
Percent Cooled	50% or more
Percent Heated	50% or more

Police/911 Wing	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	2,400
Number of PCs°	N/A
Weekly operating hours°	168
Workers on Main Shift°	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2009)	**Baseline** (Ending Date 12/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	64	64	29	N/A	77
Source (kBtu/ft^2)	212	212	96	N/A	182
Energy Cost					
$/year	$ 19,280.05	$ 19,280.05	$ 8,714.06	N/A	$ 23,338.53
$/$ft^2$/year	$ 3.01	$ 3.01	$ 1.36	N/A	$ 3.64
Greenhouse Gas Emissions					
$MtCO_2e$/year	62	62	28	N/A	75
$kgCO_2e/ft^2$/year	10	10	5	N/A	12

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.

APPENDIX H

Site Aerial Image


Lake Iliff Rd
bing
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