LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR: **BOROUGH OF AVALON**
PUBLIC SAFETY BUILDING
3100 DUNE DRIVE
AVALON, NJ 08202
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TOWNSHIP ADMINISTRATOR

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Borough of Avalon
Public Safety Building
3000 Dune Drive
Avalon, NJ 08202

Municipal Contact Person: Jeff Hesley, Municipal Green Team Liaison
Facility Contact Person: David Dean, Chief of Police

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The Public Safety Building receives electricity from the Elementary School central plant. The school bills the Borough of Avalon an agreed upon amount each month. The facility does have a neutral gas meter and receives its own utility bill. CEG has estimated the annual energy costs and energy usage from these documents using an average blended rate for electricity from the Elementary School utility bills ($ 0.129 / kWh).

The annual energy costs at this facility are as follows:

Electricity (estimated)	$ 69,660
Natural Gas (actual)	$ 7,066
Total	$ 76,726

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's and REM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	De-Lamping of T-8 Fixtures	$2,184	$1,408	1.6	866.7%
ECM #2	Interior Lighting T-8 Upgrade	$3,060	$517	5.9	153.2%
ECM #3	Interior Incandescent Lighting Upgrade	$428	$920	0.5	3125.6%
ECM #4	Water Conservatoin Opportunities	$2,488	$186	13.4	-25.2%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	30.36 KW PV System	$273,240	$17,543	15.6	60.5%
REM #2	4.2 KW Rooftop Wind Generation System	$41,313	$1,469	28.1	-46.7%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The descriptions in this table correspond to the ECM's and REM's listed in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	De-Lamping of T-8 Fixtures	2.04	11,443	0
ECM #2	Interior Lighting T-8 Upgrade	1.80	4,200	0
ECM #3	Interior Incandescent Lighting Upgrade	1.83	7,483	0
ECM #4	Water Conservatoin Opportunities	0.00	969	0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	30.36 KW PV System	0.00	37,089	0
REM #2	4.2 KW Rooftop Wind Generation System	0.0	6994.0	0.0

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for this facility:

- **ECM #1:** De-lamping of T-8 Fixtures
- **ECM #2:** Interior Lighting T-8 Upgrade
- **ECM #3:** Interior Incandescent Lighting Upgrade
- **ECM #4:** Low Flow High Performance Sink Aerators & Showerheads

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Renewable Energy Measures (REMs) were also reviewed for implementation at the Public Safety Building. CEG utilized a roof mounted solar array and a solar carport in the parking area to house a substantial PV system. The recommended 30.4 kW PV system will produce approximately 37,089 kWh of electricity annually and will reduce the facility electrical consumption from the grid by 6.5%. The system's calculated simple payback of 15.6 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, after reviewing the utility information, existing building documentation and performing the detailed site inspections, there are several energy savings opportunities in lighting and water conservation measures at the Public Safety Building. In addition, a review of the renewable energy conservation recommendations should be completed as well as investigating the available funding through the New Jersey Clean Energy Programs.

II. INTRODUCTION

The comprehensive energy audit covers the 33,600 square foot Public Safety Building which consists of the Police Department, Fire Department and Emergency Management System Department including offices, storage, holding cells, conference room, exercise room, command center, IDF room, police and fire chief sally port, and fire engine/ambulance bay garages.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc. The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings} \right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Ma\,\mathrm{int}\,enance\ Savings = \left(Yearly\ Ma\,\mathrm{int}\,enance\ Savings \times ECM\ Lifetime \right)$$

$$Internal\ Rate\ of\ \mathrm{Re}\,turn = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + IRR)^n} \right)$$

$$Net\ \mathrm{Pr}\,esent\ Value = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + DR)^n} \right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

The electric usage profile represents the actual electrical usage for the facility. Atlantic City Electric (ACE) provides electricity to the facility thru the Elementary School central plant under their Annual General Service – Secondary (AGS) rate structure. The blended electric rate for the Elementary School central plant was used for this facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. South Jersey Gas Company provides natural gas to the facility under the Basic General Supply Service (GSG) rate structure. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	12.3¢ / kWh
Natural Gas	$1.49 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: AGS
Meter No:
Customer ID No:
Third Party Utility
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Feb-09	55,947	0.0	$6,999
Mar-09	50,519	0.0	$6,368
Apr-09	35,526	0.0	$4,272
May-09	45,272	0.0	$5,308
Jun-09	60,121	0.0	$7,294
Jul-09	68,450	0.0	$8,331
Aug-09	70,337	0.0	$8,555
Sep-09	48,078	0.0	$6,014
Oct-09	28,357	0.0	$3,524
Nov-09	32,414	0.0	$4,118
Dec-09	36,301	0.0	$4,592
Jan-10	34,266	0.0	$4,285
Totals	**565,589**	**0.0 Max**	**$69,660**

AVERAGE DEMAND **0.0 KW average**

AVERAGE RATE **$0.123 $/kWh**

Figure 1
Electricity Usage Profile

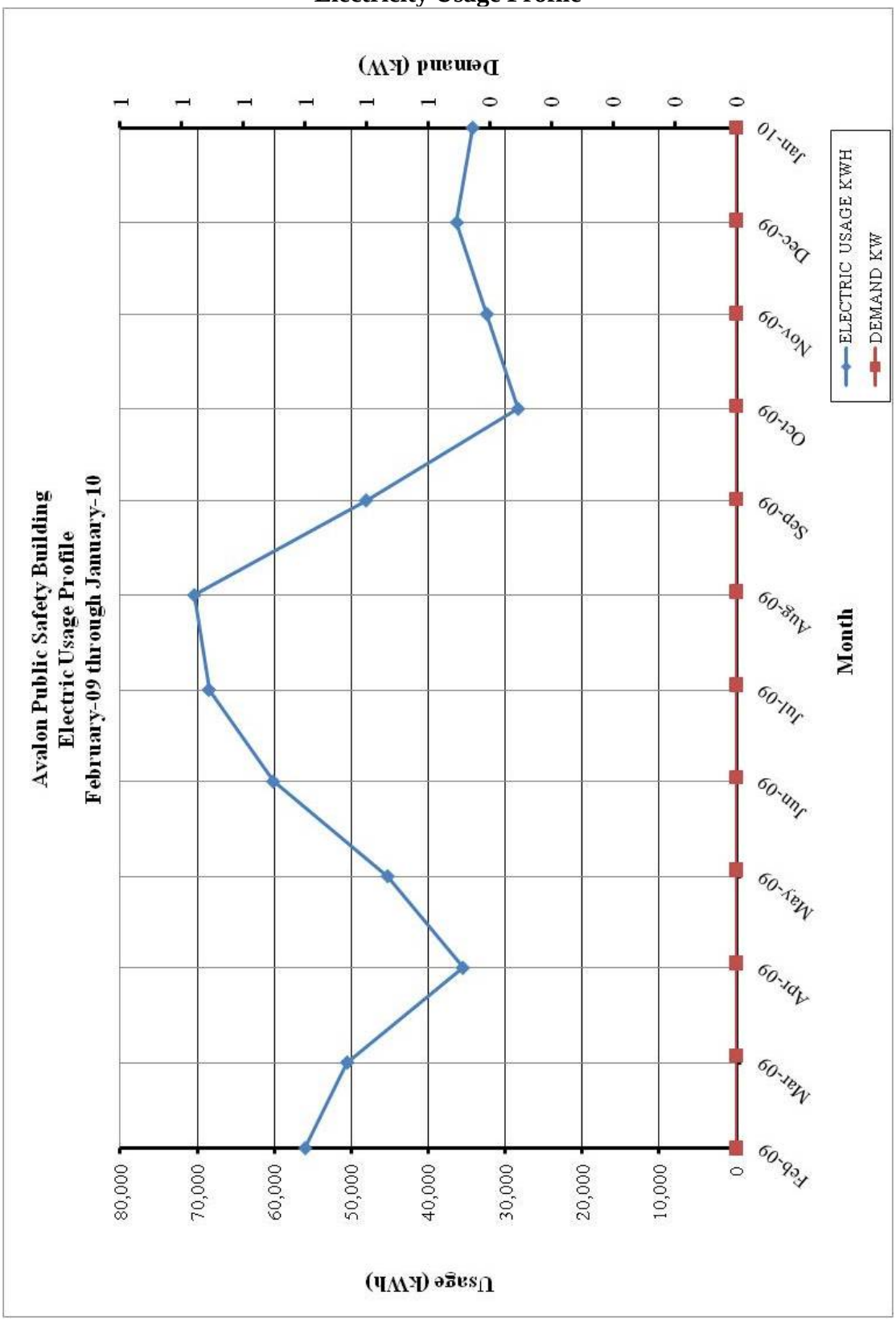
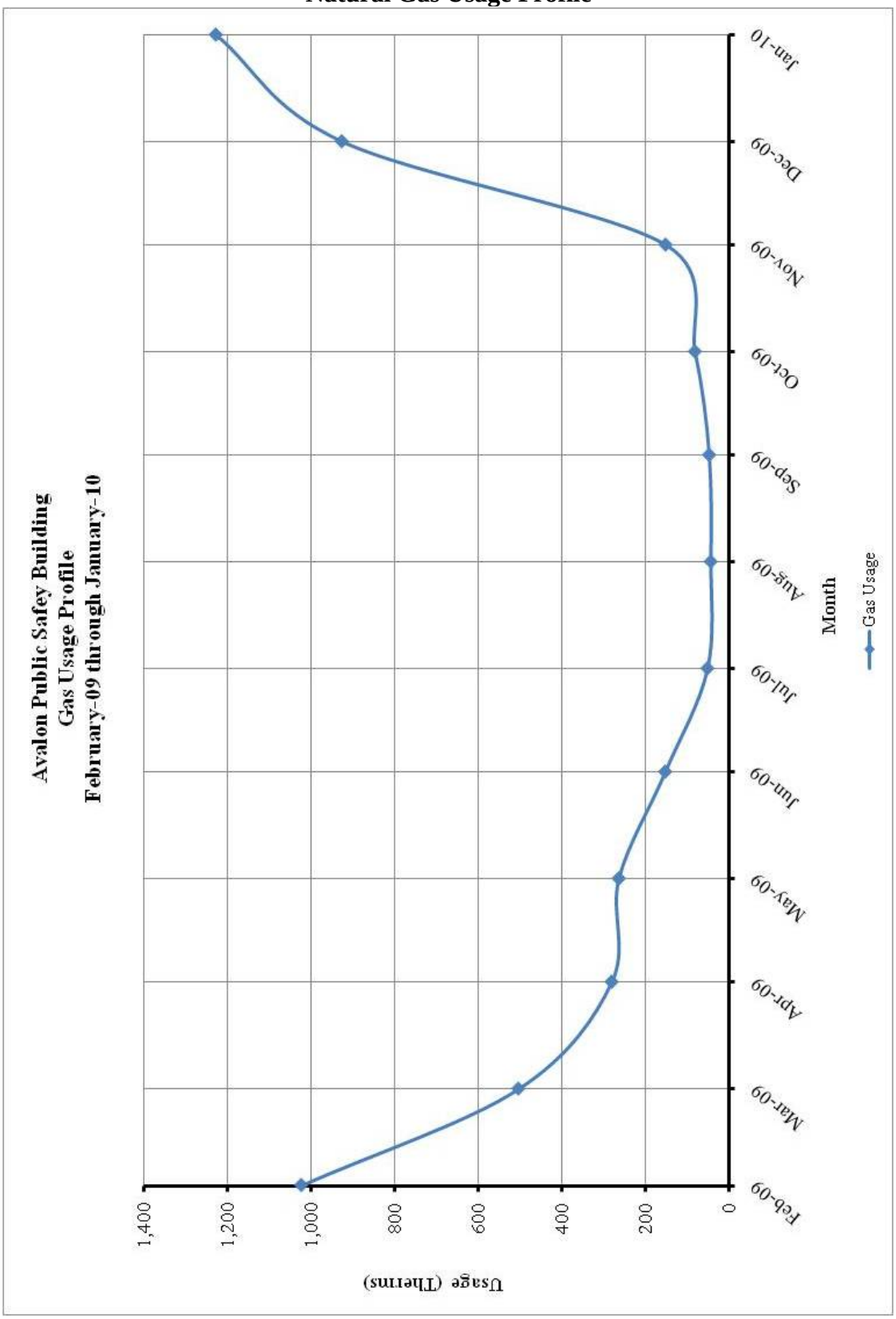


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	South Jersey Gas	
Rate:	GSG	
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Feb-09	1,023.00	$1,595.54
Mar-09	504.00	$792.65
Apr-09	281.00	$451.31
May-09	264.00	$430.77
Jun-09	153.00	$273.93
Jul-09	52.00	$100.51
Aug-09	44.00	$85.89
Sep-09	48.00	$89.17
Oct-09	82.00	$128.21
Nov-09	152.00	$218.46
Dec-09	926.00	$1,241.93
Jan-10	1,227.00	$1,657.88
TOTALS	**4,756.00**	**$7,066.25**
AVERAGE RATE:	**$1.49**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

$$Building\ \ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ \ Square\ \ Footage}$$

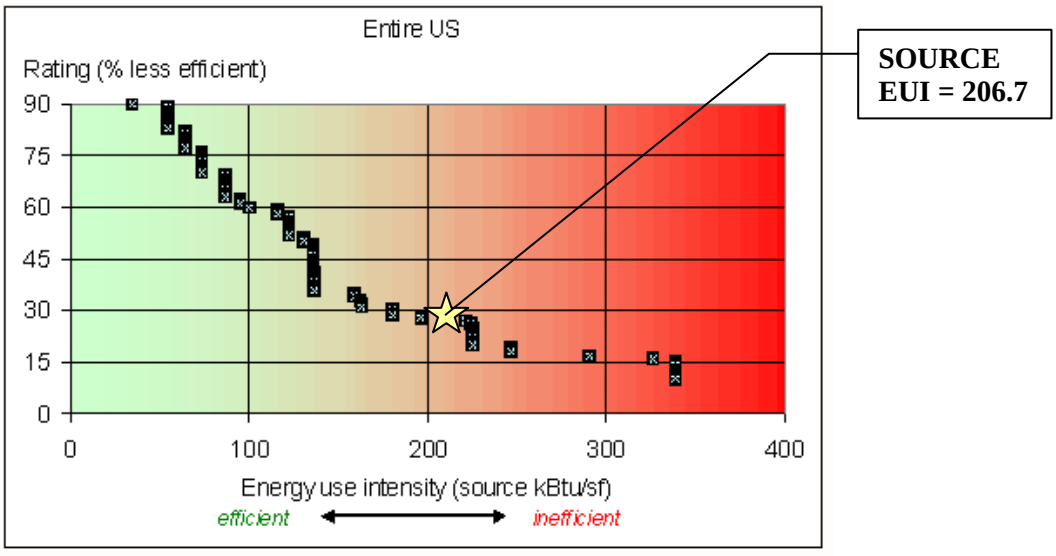
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	565588.7			1,930,920	3.340	6,449,272
NATURAL GAS		4756.0		475,600	1.047	497,953
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				2,406,520		6,947,226
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		33,600	SQUARE FEET			
BUILDING SITE EUI		*71.62*	kBtu/SF/YR			
BUILDING SOURCE EUI		*206.76*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of *Fire-Police Station.*

Figure 3
Source Energy Use Intensity Distributions: Fire-Police Station



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

User Name: avalonboro
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "avalon"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Avalon Public Safety	N/A	N/A

The Avalon Public Safety Facility falls under the "other" category which is not applicable for Energy Performance Rating. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 33,600 SF Public Safety Building consists of a new 13,600 SF, two-story structure which houses the Police Department and Emergency Management System including offices, storage, holding cells, conference room, training room, interview room, squad room, fitness room, command and dispatch center, IDF room, mechanical room, restrooms, locker rooms, and police chief sally port. The old police and emergency management department building was demolished in 2007 and the 20,000 SF fire engine & ambulance bay garages built on the site.

Exterior walls are of brick/concrete block construction on concrete footers with a metal gable roof. The exterior walls contain R-17 insulation and the attic has R-30 insulation. All windows are double-pane, thermal insulated units.

HVAC Systems

The new police/EMS portion of the Public Safety Building is heated and cooled by two (2) Packaged Trane Roof Top Units (RTUs) that contain gas-fired furnaces and DX cooling coils. The RTUs provide neutral air to the building VAV system. The first Trane unit is rated at 205,000 BTUH of heating and 19.7 tons of cooling. The second Trane unit is rated at 17.5 Tons of cooling and 205,000 BTUH of heating. There are twenty-three (23) Variable Air Volume (VAV) single duct terminal units with two-stage electric heat throughout the building. The telephone server room, computer room and dispatch server closet are heated/cooled by a Daikin split system with a 4-Ton rooftop condenser/compressor unit, 4-Ton rooftop backup unit and three (3) indoor evaporator units with electric heat. The indoor units consist of the following:

DSS-1	18,000 BTUH Cooling	20,000 BTUH Heating
DSS-2	12,000 BTUH " "	13,500 BTUH " "
DSS-3	24,000 BTUH " "	27,000 BTUH " "

The Fire House/EMS department vehicle garages and the Police Chief & Fire Chief carports are heated by seven (7) gas-fired unit heaters all rated at 100,000 BTUH. The front & rear lobby, mechanical room, and locker rooms are heated via electric unit heaters.

Exhaust System

Twelve (12) exhaust fans varying in size from 75 CFM to 3,600 CFM service the restrooms, locker rooms, elevator machine room, offices, mechanical room, electric room, fitness room, vehicle garages, etc.

HVAC System Controls

The HVAC systems within the facility are controlled via an Invensys Building System with Lonworks protocol that controls the rooftop units, VAV terminal units and exhaust fans.

Domestic Hot Water

Domestic hot water for the restrooms, locker rooms and lounge is provided by two (2) Bradford White electric hot water heaters. The domestic hot water is circulated throughout the building by hot water re-circ pumps. The circulation pumps are controlled by an aqua stat. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout the building is 4-lamp, fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. There are also T-12 fixtures utilized in the engine bay areas. Storage rooms and closets are lit with compact fluorescent lamps and the use of incandescent bulbs is seen throughout the facility. Exit signs are all LED units. The parking lots are lit with light poles and 175-Watt high pressure sodium lamps.

VI. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: De-lamping of T-8 Fixtures

Description:

Most of the hallways, offices, conference rooms, dispatch, etc. in the Police/EMS portions of this building are overlit. Occupants are complaining of glare on their computers. The recommended footcandle levels for hallways are 20 to 30 footcandles and for offices/conference rooms 60 footcandles is recommended.

This ECM would permanently de-lamp the 4-lamp fixtures to 3-lamp fixture with an aluminum reflector and the 3-lamp fixtures to 2-lamp with an aluminum reflector and a new 2-lamp ballast to obtain the recommended light levels.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for de-lamping T-8 fixtures.

From the **NJ Smart Start Appendix**, the retrofit of T-8 fixtures by permanently de-lamping & new reflectors with a total fixture Harmonic Distortion of < 20% with electronic ballasts warrants a $20 incentive per fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,704
NJ Smart Start Equipment Incentive ($):	$1,520
Net Installation Cost ($):	$2,184
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,408
Total Yearly Savings ($/Yr):	$1,408
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	866.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$21,113
Internal Rate of Return (IRR)	64%
Net Present Value (NPV)	$14,618.64

ECM #2: Interior Lighting T-8 Upgrades

Description:

The Fire House portion of this building is lit by a T-12 lighting system. Improved fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple retrofit of the existing fixture can provide substantial savings. A conventional drop-ceiling lay in fixture with four, 4-foot lamps (34 Watt lamps with magnetic ballast) has a total wattage of 144 Watts per fixture. By using the improved lamps and ballasts, the total wattage would be reduced to 86 Watts. The light levels would increase by about 15% and the light quality would increase by 35%.

Typically, T-8 lamps can fit into the existing fixtures with minimal fixture modifications. The lamps are 1" in diameter instead of the 1.5' diameter of the existing T-12 lamps. (The number after the "T" indicates the diameter in 8ths of an inch. Hence, T-8=8/8 or 1", while T-12=12/8 or 1.5".) The reduced surface area allows the use of more costly inside coatings (phosphors). The improved phosphors provide a greatly improved color rendering index (CRI). A T-12 typically has a CRI of about 55. A typical T-8 has a CRI of about 75.

Magnetic ballasts are replaced with electronic ballasts which also fit into the existing fixtures with minimal fixture modifications. Magnetic ballasts increase the energy usage of the lighting system due to their operating characteristics. An electronic ballast reduces energy usage of the lighting system. In addition, a single electronic ballast can operate up to four lamps in a fixture. Magnetic ballasts can only operate up to two lamps. The electronic ballasts could reduce the amount of ballasts in the Firehouse facility by half. This is accomplished by "tandem wiring" of ballasts. Rather than using one electronic ballast for every <u>one</u> fixture, <u>one</u> ballast may be used for <u>two or more</u> fixtures. The electrician wires a single ballast to operate the lamps in adjacent light fixtures which further reduces the number of ballasts needed.

This ECM includes retrofitting each of the existing T-12 fluorescent lamp and magnetic ballast fixtures with F32T8 lamps and high-power electronic ballasts. High efficiency electronic ballasts reduce overall wattage while maintaining the existing lumen levels of the offices and shops. The average hours of operation for this facility are 2,600 hours per year. The replacement lamps are based on General Electric Super T8 lamps and the replacement ballast is GE-432-MAX-N/Ultra Instant Start Low Power Ballast.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for retrofit of T-12 fixtures to T-8 lamps and electronic ballasts.

From the **NJ Smart Start Appendix**, the retrofit of T-12 fixtures to T-8 with electronic ballasts warrants a $15 incentive per fixture.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,600
NJ Smart Start Equipment Incentive ($):	$540
Net Installation Cost ($):	$3,060
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$517
Total Yearly Savings ($/Yr):	$517
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.9
Simple Lifetime ROI	153.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$7,749
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$3,107.02

ECM #3: Interior Incandescent Lighting Upgrades

Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 26-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM would replace all of the incandescent lamps in the Public Safety Building with the appropriate sized Compact Fluorescent Lamps (CFLs).

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for the replacement of the incandescent lamps with compact fluorescent lamps.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$428
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$428
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$920
Total Yearly Savings ($/Yr):	$920
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.5
Simple Lifetime ROI	3125.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$13,805
Internal Rate of Return (IRR)	215%
Net Present Value (NPV)	$10,559.20

ECM #4: Water Conservation Opportunities

Description:

Water conservation is defined as any action that reduces the amount of water withdrawn from water supply sources, reduces consumptive use, reduces the loss or waste of water, improves the efficiency of water use, increases recycling and reuse of water, or prevents the pollution of water. Conversely, water waste is the excessive use of potable water that is unproductive or does not reasonably sustain economic benefits or life forms, particularly where there is a shortage of potable water.

A conventional showerhead is rated to use 3 to 5 gallons per minute at normal water pressure, about 60 psi. A 5-minute shower with a conventional showerhead typically consumes 15 to 25 gallons of water. High quality replacement showerheads that deliver 1 to 2.5 gallons per minute can save many gallons per shower. Products vary in price from $10 to $50.

Faucets for restrooms, kitchen, and workroom sinks vary in flow rates. Restroom sinks need no more than 1.5 gallons per minute and kitchen sinks need about 2.5 gallons per minute while workroom sinks may include automated controls and pre-mixed temperatures.
Toilets and urinals account for almost half of a typical building's water consumption. According to the Plumbing Foundation, replacing all existing toilets with 1.6 gallons per flush, ultra-low flow models and urinals with 1.0 gallons per flush models would save almost 5,000 gallons of water per person each year.

Toilets and urinals can be retrofitted with electronic controls. Potential water savings are greater with retrofits because current fixtures generally do not meet the latest water conservation standards. Electronic controls for plumbing fixtures usually function by transmitting a continuous beam of infrared (IR) light. With toilets and urinals, the flush is actuated when the user moves away and the IR beam is no longer blocked. With toilets and urinals, some of the water savings may be attributable to reduced incidence of intentional multiple-flushing – a common practice with toilets and urinals.

This ECM would install low flow high performance sink aerators and high performance shower heads with ultra low flow.

Water Savings Calculations:

The water savings for the faucets, showerheads and urinals were calculated by using the U. S. Department of Energy Federal Energy Management Program (FEMP) energy cost calculators for faucets, showerheads and urinals. Additional information on the referenced calculators can be found at www1.eere.energy.gov/femp/technologies. The toilet water savings were calculated using the Sloan water savings calculator. Water and sewer rates obtained from the borough are as follows:

Water: $2.051/1,000 gallons + **Sewer**: $3.351/1,000 gallons = **Total**: $5.40/1,000 gallons

Summary of these water savings for the Public Safety Building are as follows:

Plumbing Fixture	# of Units	Water Cost Savings	Installed Cost	Payback(Yrs.)
Faucet	6	$109	$228	2.09
Showerhead	4	$77	$280	3.63
Urinal	4	$79	$840	10.6
Toilet	5	$69	$1,050	15.2
	Totals:	$334	$2,398	7.88 Avg.

The basis of calculation for the low flow high performance sink aerator is the UtilitySavers™ high performance Spray Stream and for the shower head the UtilitySavers™ high performance Green Shower Head with Ultra Low Flow.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,488
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$2,488
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$186
Total Yearly Savings ($/Yr):	$186
Estimated ECM Lifetime (Yr):	10
Simple Payback	13.4
Simple Lifetime ROI	-25.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,860
Internal Rate of Return (IRR)	-5%
Net Present Value (NPV)	($901.38)

* ECM Calculations encompass savings for all plumbing fixtures but CEG recommends the implementation of high performance sink aerators and high performance shower heads with low flow **only**. This is because these ECM's have a low payback period of 2.06 and 3.63 years, respectively. The payback periods for the other plumbing fixtures exceed 10 years when implemented on a singular basis making them unfavorable choices for replacement.

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed both the existing roof area and the parking lot area of the building being audited for the purposes of determining a potential for photovoltaic system. A roof area of 650 S.F. and a parking lot area of 1,500 S.F. can be utilized for a PV system totaling 2,150 S.F. A depiction of the areas utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 30.36 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 37,089 KWh annually, reducing the overall utility bill by approximately 6.5% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available roof and parking lot space on and near the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves the Borough paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	15.58 Years	60.5%	4.4%

*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

Given the large amount of capital required by the Borough to invest in a solar system through a Direct Purchase CEG does not recommend the Borough pursue this route. It would be more

advantageous for the Borough to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the Borough at a reduced rate compared to their existing electric rate.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility; with an average annual wind speed of 6.99 meters per second, it is sufficient enough to reach the cut in speed for most commercial sized wind turbines of 3.5 meters per second. Through the use of roof mounted Tangarie Gale Vertical Axis Wind Turbine the Public Safety Building would be able to produce approximately 6,994 kWh for just one turbine. Although the power generation from one turbine is acceptable, the turbine itself is not cost effective, being priced at around $70,000 installed for just one turbine. In addition to the overwhelming price, space requirements force the Public Safety Building to be a candidate for a roof mounted system. Based on our calculations the following is the payback period:

Table 8
Financial Summary – Wind Turbine System

REM #2 - WIND TURBINES	
Installation Cost ($):	$70,744
NJ Smart Start Equipment Incentive ($):	$29,431
Net Installation Cost ($):	$41,313
REC Revenue ($/Yr):	$230
Energy Savings ($/Yr):	$1,239
Total Yearly Savings ($/Yr):	$1,469
Estimated ECM Lifetime (Yr):	15
Simple Payback	28.13
Lifetime Energy Savings	$22,032

For further wind analysis refer to the **Wind Analysis Calculation Appendix.**

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile for the Public Safety Building has been estimated as this building is fed electric service from the Elementary School and there is no existing sub-metering for the Public Safety Building. Based on the estimated profile, the peak electrical consumption would occur during the summer months due to the rooftop, direct expansion cooling equipment that serves that majority of the building and the split-system cooling unit that serves the telephone, server, computer and dispatch areas. The noted equipment utilizes electric-operated equipment to provide cooling.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical heating load profile, with increasing consumption in the colder months (December – March) and a dramatic drop in consumption in the warmer months (May – September). The main heating equipment throughout the various parts of the Public Safety Building consists primarily of gas-fired equipment hence the noted profile.

Tariff Analysis:

Electricity:

Note: Description below is for the utility tariff charged to the Elementary School by Atlantic City Electric.

This facility receives electrical Delivery Service from Atlantic City Electric on an AGS Secondary (Annual General Service) utility rate. The AGS rate is available at any point of Company's system where facilities of adequate character and capacity exist for the entire electric service requirements of any customer contracting for annual service delivered at one point and metered at or compensated to the voltage of delivery. This delivery service includes the following charges: Delivery Service Charges, Distribution Demand Charges, Reactive Demand Charges, Distribution Rates, Non-Utility Generation Charges, Societal Benefits Charges, Regulatory Assets Recovery Charges, Transition Bond Charges, Market Transition Charge Tax,

Transmission Demand Charge, Regional Greenhouse Gas Initiative Recovery Charge, and Infrastructure Investment Surcharge.

Natural Gas:

This facility has natural gas serviced by South Jersey Gas Company (SJG) on its firm delivery rate, General Service Gas (GSG) from the utility and BGSS (Basic Generation Supply Service) commodity when not being served by a Third Party Supplier (TPS). This Delivery Rate has the following charges: Customer Charge, Delivery Charge, BSC Volume Charge and Commodity Charge under this rate structure. The BGSS Supply rates are designed to recover SJG's cost of gas applicable to customers who purchase gas from SJG. The company earns no profit from BGSS. BGSS consists of two (2) pricing mechanisms: Residential and Commercial customers that use less than 5,000 therms annually and Commercial and Industrial customers that consume at least 5,000 therms annually.

Imbalances occur when Third Party Suppliers (TPS) are used to supply natural gas and full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. Note: It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used otherwise, imbalances can occur, jeopardizing economics and scheduling. If the supplier does not deliver they can be placed on a very costly rate. A customer can automatically be put on an alternative supply rate by the utility.

A "firm account" refers to the type of interstate pipeline service that the utility has subscribed for and delivered on behalf of the customer. Much like the telecom industry, the pipeline space (capacity) has been deregulated. The pipeline capacity is broken down into reliability of service. "Firm service" is the highest level of reliability and is the last, in pecking order, for interruption.

Recommendations:

CEG recommends a global approach that will be consistent with the facilities operated by the Borough of Avalon with their own electrical and natural gas service. This applies to the Community Center, Public Safety Building and the Public Works facilities as included within the scope of this project. The basic recommendation is to aggregate all energy loads of the facilities with single services (electric and natural gas) and procure energy for the commodity side of these utilities utilizing a "managed approach" through an energy procurement specialist. CEG's observations are seen in both the electric and natural gas costs for the noted facilities. The average "price to compare" per kWh (kilowatt hour) for all buildings is $.152 / kWh (kWh is the common unit of electric measure). The average "price to compare" per deca-therm for natural gas is $16.28 /dth (dth is the common unit of measure). These Weighted Average Prices are as supplied via current Borough of Avalon utility suppliers.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The Borough of Avalon could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on the study period's historical consumption and current electric rates, the BOE could see an improvement of up to 15 % or up to $9,903 in its electric costs annually. (Note: Savings were

calculated using an Average Annual Consumption of 622,360 kWh and an Average fixed one-year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends that the Borough of Avalon seek an energy advisor to maximize energy savings and to apply a "managed approach" to procuring energy.

CEG's secondary recommendation coincides with the Borough of Avalon's natural gas costs. Based on the current market, (which is very competitive), the Borough of Avalon could see a savings of over 20% or up to $7,142 annually in its natural gas expenditures. Again, CEG recommends the use of any energy advisor to review alternative energy sourcing strategies and to install a "managed approach" to energy procurement.

CEG also recommends that the Borough of Avalon review their current energy purchasing strategies in order to create a future plan for purchasing. This plan should utilize, as noted above, a "managed approach." The "managed approach" will take into account creating an "energy budget" that is in line with the Borough of Avalon's budget year and risk tolerance. Risk tolerance is the appetite that a customer has for risk. Based on the reduced state and local government budgets and the general aversion for risk, the local government is required to manage this risk. The Borough of Avalon should utilize a consultant familiar with energy purchasing and contracts to ensure "best practice" is utilized when joining into a fixed term pricing contract for commodity. Typical contracts last for one to two years and are a fixed-term commitment.

Finally, CEG recommends the Borough of Avalon schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), they will learn more about the competitive supply process. They can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention is given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, the Borough of Avalon should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier. It is pertinent to note, that if the Borough of Avalon decides to enter into a commodity contract and frequently changes its suppliers, balancing of the current account should be closely monitored so that overages do not appear when the contract is close to termination.

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings that were audited as part of the NJ Clean Energy's Local Government Energy Audit Program. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. *Energy Reduction Plan* – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)

2. *Project Implementation* – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.

3. *Measurement and Verification* – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.

v. *Direct Install Program* – The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 80% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Avalon Public Safety Building

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	De-Lamping of T-8 Fixtures	$3,704	$0	$1,520	$2,184	$1,408	$0	$1,408	15	$21,113	$0	866.7%	1.6	64.41%	$14,618.64
ECM #2	Interior Lighting T-8 Upgrade	$3,600	$0	$540	$3,060	$517	$0	$517	15	$7,749	$0	153.2%	5.9	14.73%	$3,107.02
ECM #3	Interior Incandescent Lighting Upgrade	$428	$0	$0	$428	$920	$0	$920	15	$13,805	$0	3125.6%	0.5	215.04%	$10,559.20
ECM #4	Water Conservatoin Opportunities	$2,488	$0	$0	$2,488	$186	$0	$186	10	$1,860	$0	-25.2%	13.4	-4.97%	($901.38)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	30.36 KW PV System	$273,240	$0	$0	$273,240	$4,562	$12,981	$17,543	25	$438,575	$324,525	60.5%	15.6	4.03%	$32,238.85
REM #2	4.2 KW Rooftop Wind Generation System	$70,744	$0	$29,431	$41,313	$1,239	$230	$1,469	15	$22,035	$3,450	-46.7%	28.1	-6.99%	($23,776.17)

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

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SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February, 2010:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2004

Ground Source Heat Pumps

Closed Loop & Open Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit, AFUE ≥ 92%

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Premium Motors

Three-Phase Motors	$45 - $700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	$40 per electronic communicated motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$15 per fixture (1-4 lamps)
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$42 per 5 foot $65 per 6 foot

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled
Daylight Dimming - office	$50 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Public Safety Building

Building ID: 2241179
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 07, 2010

Facility
Public Safety Building
3000 Dune Drive
Avalon, NJ 08202

Facility Owner
Borough of Avalon
3100 Dune Drive
Avalon, NJ 08202

Primary Contact for this Facility
Jeffrey Hesley
3100 Dune Drive
Avalon, NJ 08202

Year Built: 2008
Gross Floor Area (ft²): 13,600

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,929,786
Natural Gas (kBtu)[4]	475,600
Total Energy (kBtu)	2,405,386

Energy Intensity[5]

Site (kBtu/ft²/yr)	177
Source (kBtu/ft²/yr)	511

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	319

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	225%
Building Type	Fire Station/Police Station

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.

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**

Certifying Professional
Michael Fischette
520 South Burnt Mill Road
Voorhees, NJ 08043

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	Public Safety Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Fire Station/Police Station	Is this an accurate description of the space in question?		☐
Location	3000 Dune Drive, Avalon, NJ 08202	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		☐
Public Safety Building (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	13,600 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	2(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40Hours(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	10(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: Pepco - Atlantic City Electric Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
01/01/2010	01/31/2010	34,266.00
12/01/2009	12/31/2009	36,301.00
11/01/2009	11/30/2009	32,414.00
10/01/2009	10/31/2009	28,357.00
09/01/2009	09/30/2009	48,078.00
08/01/2009	08/31/2009	70,337.00
07/01/2009	07/31/2009	68,450.00
06/01/2009	06/30/2009	60,121.00
05/01/2009	05/31/2009	45,272.00
04/01/2009	04/30/2009	35,526.00
03/01/2009	03/31/2009	50,519.00
02/01/2009	02/28/2009	55,947.00
Electric Consumption (kWh (thousand Watt-hours))		**565,588.00**
Electric Consumption (kBtu (thousand Btu))		**1,929,786.26**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,929,786.26**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
01/01/2010	01/31/2010	1,227.00
12/01/2009	12/31/2009	926.00
11/01/2009	11/30/2009	152.00
10/01/2009	10/31/2009	82.00
09/01/2009	09/30/2009	48.00
08/01/2009	08/31/2009	44.00
07/01/2009	07/31/2009	52.00
06/01/2009	06/30/2009	153.00
05/01/2009	05/31/2009	264.00
04/01/2009	04/30/2009	281.00

03/01/2009	03/31/2009	504.00
02/01/2009	02/28/2009	1,023.00
Gas Consumption (therms)		**4,756.00**
Gas Consumption (kBtu (thousand Btu))		**475,600.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**475,600.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Public Safety Building
3000 Dune Drive
Avalon, NJ 08202

Facility Owner
Borough of Avalon
3100 Dune Drive
Avalon, NJ 08202

Primary Contact for this Facility
Jeffrey Hesley
3100 Dune Drive
Avalon, NJ 08202

General Information

Public Safety Building	
Gross Floor Area Excluding Parking: (ft^2)	13,600
Year Built	2008
For 12-month Evaluation Period Ending Date:	January 31, 2010

Facility Space Use Summary

Public Safety Building	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	13,600
Number of PCs[o]	2
Weekly operating hours[o]	40
Workers on Main Shift[o]	10

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 01/31/2010)	**Baseline** (Ending Date 01/31/2010)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	177	177	0	N/A	78
Source (kBtu/ft^2)	511	511	0	N/A	157
Energy Cost					
$/year	$ 76,726.25	$ 76,726.25	N/A	N/A	$ 33,836.42
$/$ft^2$/year	$ 5.64	$ 5.64	N/A	N/A	$ 2.49
Greenhouse Gas Emissions					
$MtCO_2e$/year	319	319	0	N/A	141
$kgCO_2e/ft^2$/year	23	23	0	N/A	10

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group
PUBLIC SAFETY BUILDING

Rooftop Gas-Fired/DX Unit		
Tag	**AC-1**	**AC-2**
Unit Type	Rooftop	Rooftop
Qty	1	1
Location	Roof	Roof
Area Served	Public Safety Building	Public Safety Building
Manufacturer	Trane	Trane
Model #	YCD241C4LCCADE	YCD211C4LCCADE
Cooling Capacity	20-Ton	17.5-Ton
Cooling Efficiency	10.6 EER	11.0 EER
Heating Capacity (MBH)	250 input / 222.16 output	250 input / 217.46 output
Heating Efficiency	89%	87%
S/A Fan	10 HP	7.5 HP
Approx Age	1	1
Ashrae Service Life	20	20
Remaining Life	19	19
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group
PUBLIC SAFETY BUILDING

Domestic Hot Water Heaters		
Unit Type	DHW Heater	DHW Heater
Qty	1	1
Location	Kitchen	-
Area Served	Kitchen	Restrooms, Showers
Manufacturer	Bradford White	Ruud
Model #	M-I-40S5LN-B	PL66-2
Serial #	FM8370743	0189B29205
Size (Gallons)	40	65
Input Capacity (MBH/KW)	34,000 MBH	4,500 kW Upper 4,500 kW Lower
Fuel	Natural Gas	Electric
Approx Age	0	0
Ashrae Service Life	13	13
Remaining Life	13	13
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group
PUBLIC SAFETY BUILDING

Exhaust Fans

Tag	EF-1	EF-2	EF-3
Unit Type	Roof Exhaust	Ceiling Exhaust	Ceiling Exhaust
Qty	1	5	1
Location	-	-	-
Area Served	-	-	-
Manufacturer	Greenheck	Greenheck	Greenheck
Model #	LDP-90	SP-A110	SP-A1550
Fan HP	0.10	49 Watts	818 Watts
Fan CFM	225	75	1,400
Approx Age	1	1	1
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

Exhaust Fans Continued			
Tag	**EF-4**	**EF-5**	**EF-6**
Unit Type	Ceiling Exhaust	Ceiling Exhaust	Ceiling Exhaust
Qty	1	1	1
Location	-	-	-
Area Served	-	-	-
Manufacturer	Greenheck	Greenheck	Greenheck
Model #	SP-A710	SP-A510	SP-B150
Fan HP	285 Watts	224 Watts	129 Watts
Fan CFM	425	300	100
Approx Age	1	1	1
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

Exhaust Fans Continued			
Tag	**EF-7**	**EF-8**	**EF-9**
Unit Type	Ceiling Exhaust	Roof Exhaust	Centrifugal Inline
Qty	1	1	1
Location	-	-	-
Area Served	-	-	-
Manufacturer	Greenheck	Greenheck	Greenheck
Model #	SP-A190	LBP-14-3	BSQ-90-3
Fan HP	113 Watts	0.33	0.33
Fan CFM	150	1,600	875
Approx Age	1	1	1
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

Exhaust Fans Continued			
Tag	**EF-10**	**EF-11**	**EF-12**
Unit Type	Roof Exhaust	Roof Exhaust	
Qty	1	1	1
Location	-	-	-
Area Served	-	-	-
Manufacturer	Greenheck	Greenheck	Greenheck
Model #	GB-200-7	GB-330-10	SE1-20-428-B3
Fan HP	0.75	1	0.33
Fan CFM	3,600	7,125	2,400
Approx Age	1	1	1
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

PUBLIC SAFETY BUILDING

SPLIT AC UNITS		
Unit Type	Rooftop	Wall-Mounted Indoor Unit
Qty	1	1
Location	Pad - Mount	-
Area Served	Public Safety Building	Public Safety Building
Manufacturer	Daikin	Daikin
Model #	RXYMQ48MVJU	FXAQ18MV
Cooling Capacity	4-Ton Heat Pump	1.5-Ton
Cooling Efficiency	-	-
S/A Fan	-	-
Approx Age	1	1
Ashrae Service Life	20	20
Remaining Life	19	19
Comments		

SPLIT AC UNITS CONTINUED		
Unit Type	Wall-Mounted Indoor Unit	Wall-Mounted Indoor Unit
Qty	1	1
Location	-	-
Area Served	Public Safety Building	Public Safety Building
Manufacturer	Daikin	Daikin
Model #	FXAQ12MV	FXAQ24MV
Cooling Capacity	1-Ton	2-Ton
Cooling Efficiency	-	-
S/A Fan	-	-
Approx Age	1	1
Ashrae Service Life	20	20
Remaining Life	19	19
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

PUBLIC SAFETY BUILDING

VAV TERMINAL UNITS - PERFORMANCE DATA

TAG #	Design Airflow (CFM)	Electric Heater (kW)	Coil Heating Capacity (MBH)
VV-1	300	1	3.41
VV-2	425	3	10.24
VV-3	460	3	10.24
VV-4	560	5	17.08
VV-5	90	1	3.41
VV-6	215	1	3.41
VV-7	245	3	10.24
VV-8	210	2	6.83
VV-9	490	3	10.24
VV-10	205	6	20.49
VV-11	500	4	13.66
VV-12	335	4	13.66
VV-13	680	5	17.08
VV-14	1200	9	30.74
VV-15	520	2	6.83
VV-16	515	4	13.66

VAV TERMINAL UNITS - PERFORMANCE DATA CONTINUED

VV-17	515	4	13.66
VV-18	185	2	6.83
VV-19	315	2	6.83
VV-20	315	3	10.24
VV-21	395	4	13.66
VV-22	330	3	10.24
VV-23	385	4	13.66
		TOTAL MBH:	266.34

MAJOR EQUIPMENT LIST

Concord Engineering Group

PUBLIC SAFETY BUILDING

Gas-Fired Unit Heaters		
Unit Type	Ceiling Hung	Ceiling Hung
Qty	1	1
Location	Police Chief Carport	Ambulance Bay
Manufacturer	Trane	Trane
Model #	GAND012AEF	GAND012AEF
BTUH INPUT	125,000	125,000
BTUH OUTPUT	100,000	100,000
Efficiency	80%	80%
Fuel	Natural Gas	Natural Gas
Electrical Power	115V, 1PH	115V, 1PH
Approx Age	1	1
Ashrae Service Life	15	15
Remaining Life	14	14
Comments		

Gas-Fired Unit Heaters Continued		
Unit Type	Ceiling Hung	Ceiling Hung
Qty	5	1
Location	Weld Shop	Ambulance Bay
Manufacturer	Reznor	Trane
Model #	GAND012AEF	GAND012AEF
BTUH INPUT	125,000	125,000
BTUH OUTPUT	100,000	100,000
Efficiency	80%	80%
Fuel	Natural Gas	Natural Gas
Electrical Power	115V, 1PH	115V, 1PH
Approx Age	15	1
Ashrae Service Life	15	15
Remaining Life	0	14
Comments		

Investment Grade Lighting Audit

CEG Job #: 9C09187
Project: Avalon Boro Energy Audit
Address: 3000 Dune Drive
Avalon, NJ
Building SF: 13,600

" Public Safety Building"

KWH COST: $0.123

ECM #1 Through 3: Lighting Upgrade - General

EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
					Police																	
242.212	Hallway	8760	11	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	1.14	10,021.4	$1,232.64	11	2	Remove 2 Lamps - Provide New Ballast, 95% Alum. Reflector	58	0.64	5588.88	$687.43	$100.00	$1,100.00	0.51	4432.56	$545.20	2.02
242.212	Dispatch	8760	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	3,644.2	$448.23	4	2	Remove 2 Lamps - Provide New Ballast, 95% Alum. Reflector, Parabolic Lens	58	0.23	2032.32	$249.98	$140.00	$560.00	0.18	1611.84	$198.26	2.82
558		8760	6	1	Recessed Down Light, 100w R30 Lamp	100	0.60	5,256.0	$646.49	6	1	Energy Star Rated, Dimmable 26w CFL Lamp	26	0.16	1366.56	$168.09	$20.00	$120.00	0.44	3889.44	$478.40	0.25
242.211	Restroom	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	3	Remove 1 Lamp - No Ballast Change Required	86	0.09	223.6	$27.50	$22.00	$22.00	0.02	46.8	$5.76	3.82
242.21	Detective Divisioin	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$133.04	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Interview Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	107 Interview Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	108 Sergeant	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	109 Armory	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	3	Remove 1 Lamp - No Ballast Change Required	86	0.17	447.2	$55.01	$22.00	$44.00	0.04	93.6	$11.51	3.82
242.211	Holding Cell Hall	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	3	Remove 1 Lamp - No Ballast Change Required	86	0.17	447.2	$55.01	$22.00	$44.00	0.04	93.6	$11.51	3.82
242.21	Holding Cell 1	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Holding Cell 2	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Holding Cell 3	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

Investment Grade Lighting Audit

242.21	Holding Cell 4	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	136 Copy Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	3	Remove 1 Lamp - No Ballast Change Required	86	0.17	447.2	$55.01	$22.00	$44.00	0.04	93.6	$11.51	3.82
550		2600	2	1	Recessed Down Light, 100w A19 Lamp	100	0.20	520.0	$63.96	2	1	26w CFL Lamp	26	0.05	135.2	$16.63	$20.00	$40.00	0.15	384.8	$47.33	0.85
242.21	DWI Processing	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	Processing	2600	5	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.52	1,352.0	$166.30	5	3	Remove 1 Lamp - No Ballast Change Required	86	0.43	1118	$137.51	$22.00	$110.00	0.09	234	$28.78	3.82
242.21	Restroom	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Sallyport Hall	8760	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	1,822.1	$224.12	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	Sallyport	8760	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	3,644.2	$448.23	4	3	Remove 1 Lamp - No Ballast Change Required	86	0.34	3013.44	$370.65	$22.00	$88.00	0.07	630.72	$77.58	1.13
242.21	122 Fitness	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$133.04	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.31	Elevator Machine Room	650	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	58	0.06	37.7	$4.64	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.212	125 Squad Room	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.62	1,622.4	$199.56	6	2	Remove 2 Lamps - Provide New Ballast, 95% Alum. Reflector	58	0.35	904.8	$111.29	$100.00	$600.00	0.28	717.6	$88.26	6.80
242.211	128 Waiting Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	3	Remove 1 Lamp - No Ballast Change Required	86	0.17	447.2	$55.01	$22.00	$44.00	0.04	93.6	$11.51	3.82
242.21	Data Closet	650	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	67.6	$8.31	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	Men's Class 2 Locker Room	2600	5	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.52	1,352.0	$166.30	5	3	Remove 1 Lamp - No Ballast Change Required	86	0.43	1118	$137.51	$22.00	$110.00	0.09	234	$28.78	3.82
242.21	Janitor's Closet	650	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	67.6	$8.31	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	Men's Lockers/ Shower	2600	5	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.52	1,352.0	$166.30	5	3	Remove 1 Lamp - No Ballast Change Required	86	0.43	1118	$137.51	$22.00	$110.00	0.09	234	$28.78	3.82
242.21	208 Admin. Sergeant	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

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242.211	Storage	650	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	135.2	$16.63	2	3	Remove 1 Lamp - No Ballast Change Required	86	0.17	111.8	$13.75	$22.00	$44.00	0.04	23.4	$2.88	15.29
242.21	207 Conference Room	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.31	811.2	$99.78	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	206 Chief	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$133.04	4	3	Remove 1 Lamp - No Ballast Change Required	86	0.34	894.4	$110.01	$22.00	$88.00	0.07	187.2	$23.03	3.82
242.211	205 Captain	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$133.04	4	3	Remove 1 Lamp - No Ballast Change Required	86	0.34	894.4	$110.01	$22.00	$88.00	0.07	187.2	$23.03	3.82
242.21	Reception Area	2600	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.31	811.2	$99.78	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Storage	650	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	67.6	$8.31	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	209 Evidence Processing	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	215 Records Dept.	2600	6	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.62	1,622.4	$199.56	6	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	204 Evidence	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	203 Uniform Storage	2600	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	1,081.6	$133.04	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Hallway	8760	7	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.73	6,377.3	$784.41	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Women's Special Officer Room	2600	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	270.4	$33.26	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Electrical Room	650	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	67.6	$8.31	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	Police Stairway	8760	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.31	2,733.1	$336.17	3	3	Remove 1 Lamp - No Ballast Change Required	86	0.26	2260.08	$277.99	$22.00	$66.00	0.05	473.04	$58.18	1.13
221.11		8760	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	508.1	$62.49	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21		8760	2	2	2x2, 2 Lamp, 32w T8, Mag. Ballast, Recessed Mnt., Prismatic Lens	58	0.12	1,016.2	$124.99	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

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242.212	Corridor	8760	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.31	2,733.1	$336.17	3	2	Remove 2 Lamps - Provide New Ballast, 95% Alum. Reflector	58	0.17	1524.24	$187.48	$100.00	$300.00	0.14	1208.88	$148.69	2.02
242.21	EMS Chief	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Women's Locker Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	220 Janitor's Closet	650	1	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.10	67.6	$8.31	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Women's Bunk Room	1800	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	374.4	$46.05	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Men's Locker Room	2600	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	540.8	$66.52	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.21	Men's Bunk Room	1800	2	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.21	374.4	$46.05	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	226 Training Room	2600	8	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.83	2,163.2	$266.07	8	3	Remove 1 Lamp - No Ballast Change Required	86	0.69	1788.8	$220.02	$22.00	$176.00	0.14	374.4	$46.05	3.82
558		2600	8	1	Recessed Down Light, 100w R30 Lamp	100	0.80	2,080.0	$255.84	8	1	Energy Star Rated, Dimmable 26w CFL Lamp	26	0.21	540.8	$66.52	$20.00	$160.00	0.59	1539.2	$189.32	0.85
242.21	208 EOC	8760	4	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.42	3,644.2	$448.23	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
242.211	EMS Stairway	8760	3	4	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed mnt., Prismatic Lens	104	0.31	2,733.1	$336.17	3	3	Remove 1 Lamp - No Ballast Change Required	86	0.26	2260.08	$277.99	$22.00	$66.00	0.05	473.04	$58.18	1.13
221.11		8760	1	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	508.1	$62.49	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
227.21		8760	2	2	2x2, 2 Lamp, 32w T8, Mag. Ballast, Recessed Mnt., Prismatic Lens	58	0.12	1,016.2	$124.99	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.31	Garage Bays	2600	18	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	58	1.04	2,714.4	$333.87	18	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Storage	2600	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.23	603.2	$74.19	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
221.21	Bike Repair/Storage Bay	1800	4	2	1x4, 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.23	417.6	$51.36	4	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
Fire House																					
211.25	Truck Bays	2600	56	1	1x4, 1 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Acrylic Lens	30	1.68	4,368.0	$537.26	56	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00

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121.31	Air Room	1800	6	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.41	734.4	$90.33	6	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.35	626.4	$77.05	$100.00	$600.00	0.06	108	$13.28	45.17
142.21	Storage	650	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	187.2	$23.03	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	111.8	$13.75	$100.00	$200.00	0.12	75.4	$9.27	21.57
142.21	Meeting Room	2600	17	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	2.45	6,364.8	$782.87	17	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	1.46	3801.2	$467.55	$100.00	$1,700.00	0.99	2563.6	$315.32	5.39
142.21	Men's Restroom	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$92.10	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$55.01	$100.00	$200.00	0.12	301.6	$37.10	5.39
610		2600	2	4	Wall Mnt. "Vanity" Light, (4) 60w A19 Lamps	240	0.48	1,248.0	$153.50	2	4	13w CFL Lamps	26	0.05	135.2	$16.63	$36.00	$72.00	0.43	1112.8	$136.87	0.53
142.21	Meeting Room Hall	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$92.10	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$55.01	$100.00	$200.00	0.12	301.6	$37.10	5.39
142.21	Bunk Room	1800	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	518.4	$63.76	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	309.6	$38.08	$100.00	$200.00	0.12	208.8	$25.68	7.79
142.21	Office	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$92.10	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$55.01	$100.00	$200.00	0.12	301.6	$37.10	5.39
142.21	Office	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$92.10	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$55.01	$100.00	$200.00	0.12	301.6	$37.10	5.39
650	Hallway	2600	2	2	Wall Sconce, (2) 13w CFL Lamp	26	0.05	135.2	$16.63	2	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
610	Women's Restroom	2600	1	4	Wall Mnt. "Vanity" Light, (4) 60w A19 Lamps	240	0.24	624.0	$76.75	1	4	13w CFL Lamps	26	0.03	67.6	$8.31	$36.00	$36.00	0.21	556.4	$68.44	0.53
142.21	Closet	650	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.14	93.6	$11.51	1	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.09	55.9	$6.88	$100.00	$100.00	0.06	37.7	$4.64	21.57
650	Stairway	2600	7	2	Wall Sconce, (2) 13w CFL Lamp	26	0.18	473.2	$58.20	7	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
					Exterior and Exit Lights																	
728	Exterior	3600	10	1	70w MH, Architectural Arm Mntd	92	0.92	3,312.0	$407.38	10	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
730		3600	14	1	100w HPS Wallpack	125	1.75	6,300.0	$774.90	14	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
622		8760	3	1	Arm Mnt. White Globe, (1) 100w A19 Lamp	100	0.30	2,628.0	$323.24	3	1	(1) 26w CFL Lamp	26	0.08	683.28	$84.04	$20.00	$60.00	0.22	1944.72	$239.20	0.25
600	Various	8760	34	1	LED Exit Sign	5	0.17	1,489.2	$183.17	34	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		328	273		8167	29.24	109,192.4	$13,613.84	328	91			9.364	36261.98	$4,460.22		$7,792.00	5.89	25070.3	$3,083.65	2.53

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Public Safety Building
Location: Avalon, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$273,240
Annual kWh Production	37,089
Annual Energy Cost Reduction	$4,562
Annual SREC Revenue	$12,981
First Cost Premium	**$273,240**
Simple Payback:	**15.58** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.123**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$273,240	0	0	0	$0	(273,240)	0
1	$0	37,089	$4,562	$0	$12,981	$17,543	($255,697)
2	$0	36,904	$4,699	$0	$12,916	$17,615	($238,082)
3	$0	36,719	$4,840	$0	$12,852	$17,691	($220,390)
4	$0	36,535	$4,985	$0	$12,787	$17,772	($202,618)
5	$0	36,353	$5,135	$374	$12,723	$17,484	($185,135)
6	$0	36,171	$5,289	$373	$12,660	$17,576	($167,559)
7	$0	35,990	$5,447	$371	$12,597	$17,673	($149,886)
8	$0	35,810	$5,611	$369	$12,534	$17,775	($132,110)
9	$0	35,631	$5,779	$367	$12,471	$17,883	($114,227)
10	$0	35,453	$5,952	$365	$12,409	$17,996	($96,232)
11	$0	35,276	$6,131	$363	$12,347	$18,114	($78,118)
12	$0	35,099	$6,315	$362	$12,285	$18,238	($59,880)
13	$0	34,924	$6,504	$360	$12,223	$18,368	($41,512)
14	$0	34,749	$6,699	$358	$12,162	$18,504	($23,008)
15	$0	34,575	$6,900	$356	$12,101	$18,646	($4,362)
16	$0	34,403	$7,107	$354	$12,041	$18,794	$14,431
17	$0	34,231	$7,321	$353	$11,981	$18,949	$33,380
18	$0	34,059	$7,540	$351	$11,921	$19,110	$52,490
19	$0	33,889	$7,766	$349	$11,861	$19,279	$71,769
20	$0	33,720	$7,999	$347	$11,802	$19,454	$91,223
21	$1	33,551	$8,239	$346	$11,743	$19,637	$110,860
22	$2	33,383	$8,487	$344	$11,684	$19,827	$130,687
23	$3	33,216	$8,741	$342	$11,626	$20,025	$150,711
24	$4	33,050	$9,003	$340	$11,568	$20,231	$170,942
25	$5	32,885	$9,273	$339	$11,510	$20,445	$191,386
	Totals:	873,667	$166,325	$7,482	$305,783	$464,626	($950,936)
				Net Present Value (NPV)		**$191,411**	
				Internal Rate of Return (IRR)		**4.4%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Public Safety Building	2150	Sunpower SPR230	132	14.7	1,941	30.36	37,089	4,356	15.64

PVWatts

AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	30.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	24.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	1972	3.08
2	3.33	2329	3.63
3	4.31	3252	5.07
4	5.20	3705	5.78
5	5.85	4231	6.60
6	6.14	4118	6.42
7	6.06	4160	6.49
8	5.54	3823	5.96
9	4.85	3287	5.13
10	3.76	2684	4.19
11	2.65	1881	2.93
12	2.23	1647	2.57
Year	4.38	37089	57.86

.= Proposed PV Layout

Notes:

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

Energy-Efficient Products
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- Purchasing Specifications
- Product Designation Process
- Energy Cost Calculators
- FEMP Standby Power Data Center
- Model Language
- Resources

New & Emerging Technologies

Renewable Energy

Distributed Energy Resources / Combined Heat & Power

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Energy Cost Calculator for Faucets and Showerheads

Vary utility cost, hours of operation, and /or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to the default value).			Defaults	
Water Saving Product	Faucet		*Faucet*	*Showerhead*
Flow Rate	1	gpm	*2.2 gpm*	*2.5 gpm*
Water Cost (including waste water charges)	5.4	$/1000 gal	*$4/1000 gal*	*$4/1000 gal*
Gas Cost	1.49	$/therm	*0.60 $/therm*	*0.60 $/therm*
Electricity Cost	.123	$/kWh	*0.06 $/kWh*	*0.06 $/kWh*
Minutes per Day of Operation	20	minutes	*30 minutes*	*20 minutes*
Days per Year of Operation	365	days	*260 days*	*365 days*
Quantity to be Purchased	6	unit(s)	*1 unit*	*1 unit*

Calculate | Reset

OUTPUT SECTION

Performance per Faucet	Your Choice	Base Model	FEMP Recommended Level	Best Available	Self Closing Faucet (gallon per cycle)
WATER USE ONLY					
Gallon per Minute	1 gpm	2.2	2	1.5	0.25
Annual Water Use	7300 gal	16060	14600	10950	3650
Annual Water Cost	$ 39	$ 87	$ 79	$ 59	$ 20
Lifetime Water Cost	$ 328	$ 731	$ 664	$ 496	$ 168
WITH ELECTRIC WATER HEATING					
Annual Energy Use	412 kWh	907	825	619	206
Annual Energy Cost	$ 51	$ 112	$ 101	$ 76	$ 25
Lifetime Energy Cost	$ 397	$ 875	$ 796	$ 597	$ 199
Lifetime Energy and Water Cost Savings	$ 881	$ 0	$ 146	$ 513	$ 1239
Lifetime Energy and Water Cost Savings for 6 Faucet(s)	$ 5286	$ 0	$ 876	$ 3078	$ 7434
WITH GAS WATER HEATING					
Annual Energy Use	23 therms	50	46	34	11
Annual Energy Cost	$ 34	$ 75	$ 69	$ 51	$ 16
Lifetime Energy Cost	$ 282	$ 623	$ 573	$ 423	$ 133
Lifetime Energy and Water Cost Savings	$ 744	$ 0	$ 117	$ 435	$ 1053
Lifetime Energy and Water Cost Savings for 6 Faucet(s)	$ 4464	$ 0	$ 702	$ 2610	$ 6318

For electric water heating applications, your selection of an energy saving faucet with a flow rate of 1 gallon(s) per minute will have a combined energy and water cost savings (per faucet) of $ 881 over an estimated 10 year life expectancy compared to the base model.

For gas water heating applications, your selection of an energy saving faucet with a flow rate of 1 gallon(s) per minute will have a combined energy and water cost savings (per faucet) of $ 744 over an estimated 10 year life expectancy compared to the base model.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for faucets or showerheads.
- Lifetime energy cost and lifetime water cost is the sum of the discounted value of the annual energy and water costs based on an assumed faucet or showerhead life of 10 years.
- Future gas and electricity price trends and a discount rate of 3.2% are based on Federal guidelines.
- $0.06 per kWh is the Federal average electricity price in the U.S.
- $0.60 per therm is the Federal average gas price in the U.S.
- The assumed combined water and waste-water price is $4.00/1000 gallons.

Disclaimer

This cost calculator is a screening tool that estimates a product's lifetime energy cost savings at various efficiency levels. Maintenance and installation costs do not vary significantly among the same product having different efficiencies; so, these costs are not included in this calculator tool. For a detailed life-cycle cost analysis, FEMP has developed a tool called Building Life-Cycle Cost (BLCC). This downloadable tool allows the user to vary interest rates, installation costs, maintenance costs, salvage values, and life expectancy for a product or an entire energy project.

Water Saving Product Flow Rate in gallons per minute. Default for a faucet is 2.2 gallons per minute. Default for a showerhead is 2.5 gallons per minute. Waster cost including waste water charges in dollars per 1000 gallons. Default for a faucet is 4 dollars per 1000 gallons. Default for a showerhead is 4 dollars per 1000 gallons. Gas cost in dollars per therm. Default for a faucet is 0.60 dollars per therm. Default for a showerhead is 0.60 per therm. Electricity cost in dollars per kilowatt hour. Default for a faucet is 0.06 dollars per kilowatt hour. Default for a showerhead is 0.06 dollars per kilowatt hour. Minutes per day of operation, measured in minutes. Default for a faucet is 30 minutes. Default for a showerhead is 20 minutes. Days per year of operation, measured in days. Default for a faucet is 260 days. Default for a showerhead is 365 days. Quantity to be purchased, measured in units. Default for a faucet is 1 unit. Default for a showerhead is 1 unit. Performance for faucet or showerhead, depending on selection above. Your Choice with Water Use Only Form Labels Gallons per minute based on your choice, for water use only. Annual water use based on your choice, for water use only. Annual water cost based on your choice, for water use only. Lifetime water cost based on your choice, for water use only. Base Model with Water Use Only Form Labels Gallons per minute based on the base model, for water use only. Annual water use based on the base model, for water use only. Annual water cost based on the base model, for water use only. Lifetime water cost based on the base model, for water use only. FEMP Recommended Levels with Water Use Only Form Labels Gallons per minute based on FEMP recommended levels, for water use only. Annual water use based on FEMP recommended levels, for water use only. Annual water cost based on FEMP recommended levels, for water use only. Lifetime water cost based on FEMP recommended levels, for water use only. 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Energy Cost Calculator for Faucets and Showerheads

Vary utility cost, hours of operation, and / or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to the default value).			Defaults	
Water Saving Product	Showerhead		*Faucet*	*Showerhead*
Flow Rate	1.5	gpm	*2.2 gpm*	*2.5 gpm*
Water Cost (including waste water charges)	5.4	$/1000 gal	*$4/1000 gal*	*$4/1000 gal*
Gas Cost	1.49	$/therm	*0.60 $/therm*	*0.60 $/therm*
Electricity Cost	.123	$/kWh	*0.06 $/kWh*	*0.06 $/kWh*
Minutes per Day of Operation	10	minutes	*30 minutes*	*20 minutes*
Days per Year of Operation	365	days	*260 days*	*365 days*
Quantity to be Purchased	4	unit(s)	*1 unit*	*1 unit*

Calculate | Reset

OUTPUT SECTION

Performance per Showerhead	Your Choice	Base Model	FEMP Recommended Level	Best Available	Self Closing Faucet (gallon per cycle)
WATER USE ONLY					
Gallon per Minute	1.5 gpm	2.5	2.2	1.5	n/a
Annual Water Use	5475 gal	9125	8030	5475	n/a
Annual Water Cost	$ 30	$ 49	$ 43	$ 30	$ n/a
Lifetime Water Cost	$ 252	$ 412	$ 361	$ 252	$ n/a
WITH ELECTRIC WATER HEATING					
Annual Energy Use	712 kWh	1186	1044	712	n/a
Annual Energy Cost	$ 88	$ 146	$ 128	$ 88	$ n/a
Lifetime Energy Cost	$ 687	$ 1144	$ 1007	$ 687	$ n/a
Lifetime Energy and Water Cost Savings	$ 617	$ 0	$ 188	$ 617	$ n/a
Lifetime Energy and Water Cost Savings for 4 Showerhead(s)	$ 2468	$ 0	$ 752	$ 2468	$ n/a
WITH GAS WATER HEATING					
Annual Energy Use	39 therms	66	58	39	n/a
Annual Energy Cost	$ 58	$ 98	$ 86	$ 58	$ n/a
Lifetime Energy Cost	$ 481	$ 813	$ 714	$ 481	$ n/a
Lifetime Energy and Water Cost Savings	$ 492	$ 0	$ 150	$ 492	$ n/a
Lifetime Energy and Water Cost Savings for 4 Showerhead(s)	$ 1968	$ 0	$ 600	$ 1968	$ n/a

For electric water heating applications, your selection of an energy saving showerhead with a flow rate of 1.5 gallon(s) per minute will have a combined energy and water cost savings (per showerhead) of $ 617 over an estimated 10 year life expectancy compared to the base model.

For gas water heating applications, your selection of an energy saving showerhead with a flow rate of 1.5 gallon(s) per minute will have a combined energy and water cost savings (per showerhead) of $ 492 over an estimated 10 year life expectancy compared to the base model.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for faucets or showerheads.
- Lifetime energy cost and lifetime water cost is the sum of the discounted value of the annual energy and water costs based on an assumed faucet or showerhead life of 10 years.
- Future gas and electricity price trends and a discount rate of 3.2% are based on Federal guidelines.
- $0.06 per kWh is the Federal average electricity price in the U.S.
- $0.60 per therm is the Federal average gas price in the U.S.
- The assumed combined water and waste-water price is $4.00/1000 gallons.

Disclaimer

This cost calculator is a screening tool that estimates a product's lifetime energy cost savings at various efficiency levels. Maintenance and installation costs do not vary significantly among the same product having different efficiencies; so, these costs are not included in this calculator tool. For a detailed life-cycle cost analysis, FEMP has developed a tool called Building Life-Cycle Cost (BLCC). This downloadable tool allows the user to vary interest rates, installation costs, maintenance costs, salvage values, and life expectancy for a product or an entire energy project.

Water Saving Product Flow Rate in gallons per minute. Default for a faucet is 2.2 gallons per minute. Default for a showerhead is 2.5 gallons per minute. Waster cost including waste water charges in dollars per 1000 gallons. Default for a faucet is 4 dollars per 1000 gallons. Default for a showerhead is 4 dollars per 1000 gallons. Gas cost in dollars per therm. Default for a faucet is 0.60 dollars per therm. Default for a showerhead is 0.60 per therm. Electricity cost in dollars per kilowatt hour. Default for a faucet is 0.06 dollars per kilowatt hour. Default for a showerhead is 0.06 dollars per kilowatt hour. Minutes per day of operation, measured in minutes. Default for a faucet is 30 minutes. Default for a showerhead is 20 minutes. Days per year of operation, measured in days. Default for a faucet is 260 days. Default for a showerhead is 365 days. Quantity to be purchased, measured in units. Default for a faucet is 1 unit. Default for a showerhead is 1 unit. 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Energy Cost Calculator for Urinals

Vary water cost, frequency of operation, and /or efficiency level.

INPUT SECTION

This calculator assumes that early replacement of a urinal or toilet will take place with 10 years of life remaining for existing fixture.

Input the following data (if any parameter is missing, calculator will set to default value).		Defaults
Water Saving Product	Urinal	*Urinal*
Gallons per Flush	1 gpf	*1.0 gpf*
Quantity to be Purchased	4	*1*
Water Cost (including waste water charges)	5.4 $/1000 gal	*$4/1000 gal*
Flushes per Day	20 flushes	*30 flushes*
Days per Year	365 days	*260 days*

Calculate Reset

OUTPUT SECTION

Performance per urinal	Your Choice	Typical Existing Unit	Recommended Level (New Unit)	Best Available
Gallon per Flush	1 gpf	3	1	0
Annual Water Use	7300 gal	21900	7300	0
Annual Water Cost	$ 39	$ 118	$ 39	$ 0
10-Year Water Cost	$ 329	$ 995	$ 329	$ 0
Water Cost Savings (for replacing existing unit 10 years early)	$ 666	$ 0	$ 666	$ 995

By replacing your existing urinal, having a flow rate of 1 gallon(s) per flush, you will have a water cost savings (per unit) of $ 666 over 10 years.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for toilets or urinals.
- The assumed combined water and waste-water price is $4/1000 gallons.

Disclaimer

This cost calculator is a screening tool that estimates a product's lifetime energy cost savings at various efficiency levels. Maintenance and installation costs do not vary significantly among the same product having different efficiencies; so, these costs are not included in this calculator tool. For a detailed life-cycle cost analysis, FEMP has developed a tool called Building Life-Cycle Cost (BLCC). This downloadable tool allows the user to vary interest rates, installation costs, maintenance costs, salvage values, and life expectancy for a product or an entire energy project.

Gallons per Flush. Default is Urinal 1.0 gpf, Toilet 1.0 gpf Quantity to be purchased. Default is Urinal 1, Toilet 1 Water Cost (including waste water charges) amount per 1000 gallons. Default is Urinal $4/1000 gal, Toilet $4/1000 gal Flushes per day. Default is Urinal 30 flushes, Toilet 30 flushes Days per year. Default is Urinal 260 days, Toilet 260 days Performance per Gallon per flush your choice Gallon per flush typical existing unit Gallon per flush recommended level (new unit) Gallon per flush best available Annual Water Use your choice per gallon Annual Water Use typical existing unit Annual Water Use recommended level (new unit) Annual Water Use best bvailable Annual Water Cost your choice amount of Annual Water Cost typical existing unit amount of Annual Water Cost recommended level (new unit) amount of Annual Water Cost best bvailable amount of 10-year Water Cost your choice amount of 10-year Water Cost typical existing unit amount of 10-year Water Cost recommended level (new unit) amount of 10-year Water Cost best bvailable amount of Water Cost Savings (for replacing existing unit 10 years early) your choice amount of Water Cost Savings (for replacing existing unit 10 years early) typical existing unit amount of Water Cost Savings (for replacing existing unit 10 years early) recommended level (new unit) amount of Water Cost Savings (for replacing existing unit 10 years early) best bvailable amount of By replacing your existing having a flow rate of gallon(s) per flush, you will have a water cost savings (per unit) of $ over 10 years.

Printable Version

REM #2 - WIND TURBINES	
Installation Cost ($):	$70,744
NJ Smart Start Equipment Incentive ($):	$29,431
Net Installation Cost ($):	$41,313
REC Revenue ($/Yr):	$230
Energy Savings ($/Yr):	$1,239
Total Yearly Savings ($/Yr):	$1,469
Estimated ECM Lifetime (Yr):	15
Simple Payback	28.13
Lifetime Energy Savings	$22,032

VINELAND DEVELOPMENT CENTER WIND CALCULATIONS

ANALYSIS - 1

Month	Days	Hours	Data Avg.Wind Speed, mph	Adjusted Avg. Wind Speed, mph	Adjusted Avg. Wind Speed, m/s	Rated Power kWe	Turbine #1 Generation, kWh	Total Generation, kWh	Electric Cost Offset	Annual Maint Cost	Wind REC Revenue
January	31	744	16.097	15.729	7.03	0.761	566	566	$76		$14
February	28	672	19.214	18.775	8.39	1.277	858	858	$116		$21
March	31	744	16.290	15.918	7.12	0.791	588	588	$79		$15
April	30	720	17.900	17.491	7.82	1.037	746	746	$101		$19
May	31	744	14.806	14.468	6.47	0.617	459	459	$62		$11
June	30	720	14.900	14.559	6.51	0.627	452	452	$61		$11
July	31	744	13.323	13.018	5.82	0.473	352	352	$47		$0
August	31	744	13.677	13.365	5.97	0.496	369	369	$50		$0
September	30	720	17.267	16.872	7.54	0.940	677	677	$91		$17
October	31	744	16.806	16.422	7.34	0.869	647	647	$87		$16
November	30	720	12.567	12.279	5.49	0.423	305	305	$41		$8
December	31	744	19.387	18.944	8.47	1.311	975	975	$131		$24
Annual	**365**	**8760**		**15.653**	**6.998**		**6,994**	**6,994**	**$942**	**$12,600**	**$157**

Wind REC	$0.0250
Electric Cost	$0.1347
Wind Shear Exponent alpha	0.150
Wind Data Height (m)	11
Hub height (m)	9

35 feet\
30

Wind Systems
Production Rebate Amount
Feasibility Study 50% of project costs up to $50,000 Incentive
1-16,000 $3.20 per kWh $29,430.63
16,000-750,000 $0.50 per kWh

$29,430.63

ANALYSIS - 2

Wind Speed, mph	Hours at Speed	Adjusted Speed, mph	Adjusted Speed, m/s	Rate Output (kWe)	Generated kWh
0.00	504	0.000	0.00	0.00	0
3.00	24	2.931	1.31	0.07	2
6.00	24	5.863	2.62	0.13	3
7.00	24	6.840	3.06	0.16	4
8.00	192	7.817	3.49	0.20	38
9.00	120	8.794	3.93	0.24	29
10.00	528	9.771	4.37	0.29	151
11.00	600	10.749	4.81	0.33	198
12.00	336	11.726	5.24	0.39	130
13.00	1032	12.703	5.68	0.45	466
14.00	480	13.680	6.12	0.53	254
15.00	1032	14.657	6.55	0.64	659
16.00	432	15.634	6.99	0.75	323
17.00	1008	16.611	7.43	0.90	906
18.00	360	17.589	7.86	1.05	379
19.00	168	18.566	8.30	1.23	207
20.00	216	19.543	8.74	1.43	309
21.00	120	20.520	9.17	1.68	202
22.00	168	21.497	9.61	2.01	337
23.00	192	22.474	10.05	2.34	449
24.00	240	23.451	10.48	2.69	645
25.00	120	24.429	10.92	3.04	364
26.00	216	25.406	11.36	3.42	739
27.00	48	26.383	11.79	3.81	183
28.00	96	27.360	12.23	4.07	391
29.00	48	28.337	12.67	4.20	202
30.00	24	29.314	13.10	4.29	103
31.00	96	30.291	13.54	4.27	410
32.00	24	31.269	13.98	4.25	102
33.00	120	32.246	14.42	4.23	508
34.00	48	33.223	14.85	4.21	202
35.00	24	34.200	15.29	4.20	101
36.00	24	35.177	15.73	4.20	101
38.00	24	37.131	16.60	4.20	101
62.00	24	60.583	27.08	0.000	0
126.00	24	123.120	55.04	0.000	0
		AVG	10.68		
	8,760				9,197
					0.2624735

Power Curve Data	
Vm (m/s)	Power (kWe)
0.00	0.00
3.00	0.15
4.00	0.25
5.00	0.35
6.00	0.50
7.00	0.75
8.00	1.10
9.00	1.55
10.00	2.30
11.00	3.10
12.00	4.00
13.00	4.30
14.00	4.25
15.00	4.20
16.00	4.20
17.00	4.20
18.00	4.20
19.00	4.20
20.00	4.20

	Turbine #1 Generation, kWh	Turbine #2 Generation, kWh	Turbine #3 Generation, kWh	Total Generation, kWh	Electric Cost Offset	Annual Maint Cost
Annual	9,197			9,197	$1,239	$12,600

Description	Qty	$/Unit	Material Cost	Labor Cost	Total
Gale Vertical Axis	1	$28,496	$28,496	$14,248	$42,744
Misc Costs	1	$20,000	$20,000	$0	$20,000
Crane	1	$8,000	$8,000	$0	$8,000
Sub-Total			$56,496	$14,248	$70,744
NJ Incentive					$29,431
Total Cose Less Incentive					$41,313
					$138
Annual Maintenance	1	$250	$250		