LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

BOROUGH OF AVALON
BOROUGH HALL
3100 DUNE DRIVE
AVALON, NJ 08202
ATTN: MR. JEFF HESLEY
TOWNSHIP ADMINISTRATOR

PREPARED BY:

CONCORD ENGINEERING GROUP
520 S. BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CEG CONTACT:

SAM DORIA
DIRECTOR, CX AND ENERGY AUDITS
EMAIL: SDORIA@CEG-INC.NET

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I. EXECUTIVE SUMMARY

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

Borough of Avalon
Avalon Borough Hall
3100 Dune Drive
Avalon, NJ 08202

Municipal Contact Person: Jeff Hesley, Municipal Green Team Liaison
Facility Contact Person: Jeff Hesley

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 Borough Hall receives electricity, hot water and chilled water from the Elementary School central plant. The Elementary School bills the Borough of Avalon an agreed upon amount each month. CEG has estimated the annual energy usage from these documents for the Borough Hall using an average blended rate for electricity and natural gas from the Elementary School utility bills ($ 0.129/kWh and $1.60/therm) and the actual electric and gas charges from the Elementary School.

The annual energy costs at the Avalon Borough Hall (as billed by the Elementary School Central Plant) for 2009 are as follows:

Electricity	$ 31,403
Natural Gas	$ 35,187
Total	$ 66,590

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	Interior Lighting Upgrades (T12 to T8 Retrofits)	$20,010	$2,037	9.8	52.7%
ECM #2	Interior Incandescent Lighting Upgrades	$80	$43	1.9	701.8%
ECM #3	Occupancy Sensors	$2,730	$368	7.4	102.2%
ECM #4	Exterior Building Incandescent Lighting Upgrades	$5,035	$1,569	3.2	367.4%
ECM #5	Install High Efficiency Low-E Windows in the Courtroom	$18,000	$1,079	16.7	49.9%
ECM #6	Water Conservation Opportunities	$1,790	$161	11.1	-10.1%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	15.64 KW Rooftop PV System	$140,760	$9,152	15.4	62.5%
REM #2	35.42 KW Parking Lot PV System	$256,650	$20,727	12.4	101.9%
REM #3	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	Interior Lighting Upgrades (T12 to T8 Retrofits)	6.38	15,791	0.0
ECM #2	Interior Incandescent Lighting Upgrades	0.16	332	0.0
ECM #3	Occupancy Sensors	0.00	2,856	0.0
ECM #4	Exterior Building Incandescent Lighting Upgrades	0.00	6,046	0.0
ECM #5	Install High Efficiency Low-E Windows in the Courtroom	0.00	3,343	405.0
ECM #6	Water Conservation Opportunities	0.00	488	0.0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	15.64 KW Rooftop PV System	0.0	19107.0	0.0
REM #2	35.42 KW Parking Lot PV System	0.0	43271.0	0.0
REM #3	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:** Interior T-12 Lighting Upgrades
- **ECM #2:** Interior Incandescent Lighting Upgrades
- **ECM #3:** Occupancy Sensors
- **ECM #4:** Exterior Building Lighting Upgrade
- **ECM #6:** Low Flow High Performance Sink Aerators

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 hot water and chilled water 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 Avalon Borough Hall. There are two (2) viable options for renewable energy measures which are discussed below:

CEG utilized roof mounted solar arrays at two locations on the Senior Center and Borough Hall roofs to house the photovoltaic system. The recommended 15.6 kW PV system will produce approximately 19,107 kWh of electricity annually and will reduce the Borough Hall electrical consumption from the Elementary School central plant by 7.8 %. The system's calculated simple payback of 15.38 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends that the Owner review all funding options before deciding to not implement this renewable energy measure.

In addition to a photovoltaic rooftop array, CEG has also analyzed the options for a parking lot solar array. The recommended 35.42 kW PV system will produce approximately 43,271 kWh of electricity annually and will reduce the Borough Hall electrical consumption from the Elementary School central plant by 17.8 %. The system's calculated simple payback of 12.4 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends that the Owner review all funding options before deciding to not implement this renewable energy measure.

In addition to the above recommendations, based on the review of the facility's energy bills and discussions with the facility management team, the energy audit team recommends Retro-Commissioning of this facility to meet the following objectives:

- Bring existing HVAC equipment to its proper operational state including all air distribution systems
- Reduce energy use and energy costs
- Improve indoor air quality
- Verify the installation and performance of identified system upgrades
- Address overall building energy use and demand and identify areas of highest energy use and demand
- Identify the location of the most comfort problems or trouble spots in the building
- Review current O&M practices

The Borough Hall can benefit from a retro-commissioning of all HVAC systems. Several of the older VAV terminal units are not functioning properly or are missing hot water coils needed for heating the perimeter spaces. Controls need to be calibrated and programmed to optimize energy savings.

Overall, after reviewing the utility information, existing building documentation and performing the detailed site inspections, there are several energy savings opportunities in lighting, lighting controls and water conservation measures at the Borough Hall. 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 16,132 square foot Avalon Borough Hall/Senior Center which includes administration offices, conference rooms, court room, code officials spaces, mechanical rooms, janitor closets, restrooms, library/copy room, kitchen, borough clerk, tax assessor/zoning offices, and the senior center. The facility was built in 1980 then expanded in 1996. The building is a block structure with brick siding on a concrete slab foundation and a flat built-up roof with asphalt gravel roof. The 1996 addition demolished the oldest section of the hall and connected the administration wing to the senior citizen center.

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 estimated electrical usage for the facility. Atlantic City Electric (ACE) provides electricity to the facility through the Elementary School central plant under their Annual General Service – Secondary (AGS) rate structure. In addition, the Elementary School central plant provides chilled water which is pumped to the Borough Hall. 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 Elementary School.

The gas usage profile shows the estimated natural gas energy usage for the Elementary School Central Plant in producing hot water for the Borough Hall. South Jersey Gas Company provides natural gas to the Elementary School central plant 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 billing history from the Elementary School Central Plant charges provided, the average cost for utilities at this facility is estimated as follows:

Description	Average
Electricity	12.9 ¢ / kWh
Natural Gas	$ 1.60 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY		
MONTH OF USE	**CONSUMPTION KWH**	**TOTAL BILL**
Feb-09	15,884	$2,049
Mar-09	16,023	$2,067
Apr-09	14,364	$1,853
May-09	15,961	$2,059
Jun-09	17,550	$2,264
Jul-09	24,295	$3,134
Aug-09	30,264	$3,904
Sep-09	29,372	$3,789
Oct-09	25,659	$3,310
Nov-09	19,744	$2,547
Dec-09	16,760	$2,162
Jan-10	17,558	$2,265
Totals	**243,434**	**$31,403**
AVERAGE RATE	**$0.129**	**$/kWh**

Figure 1
Electricity Usage Profile

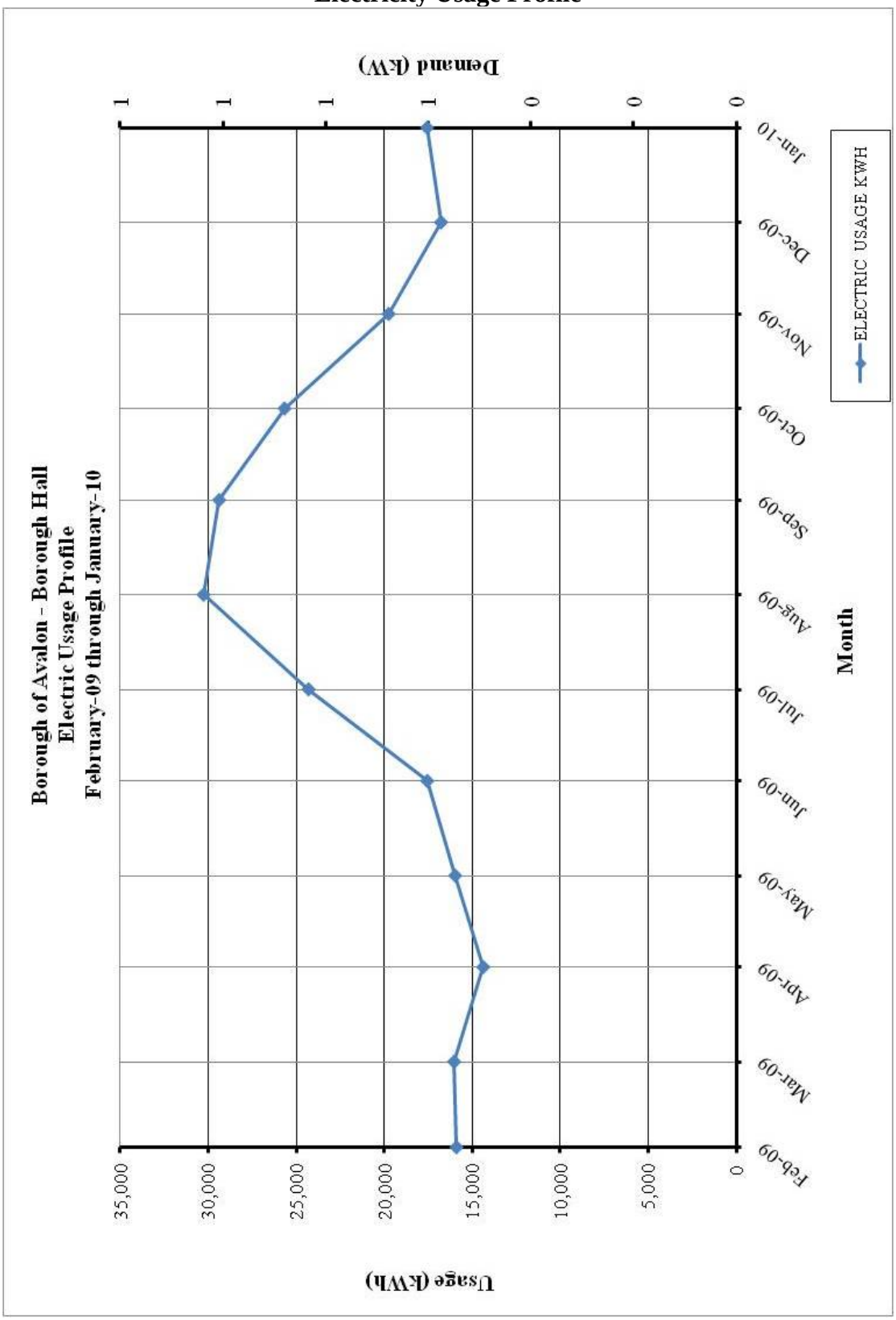
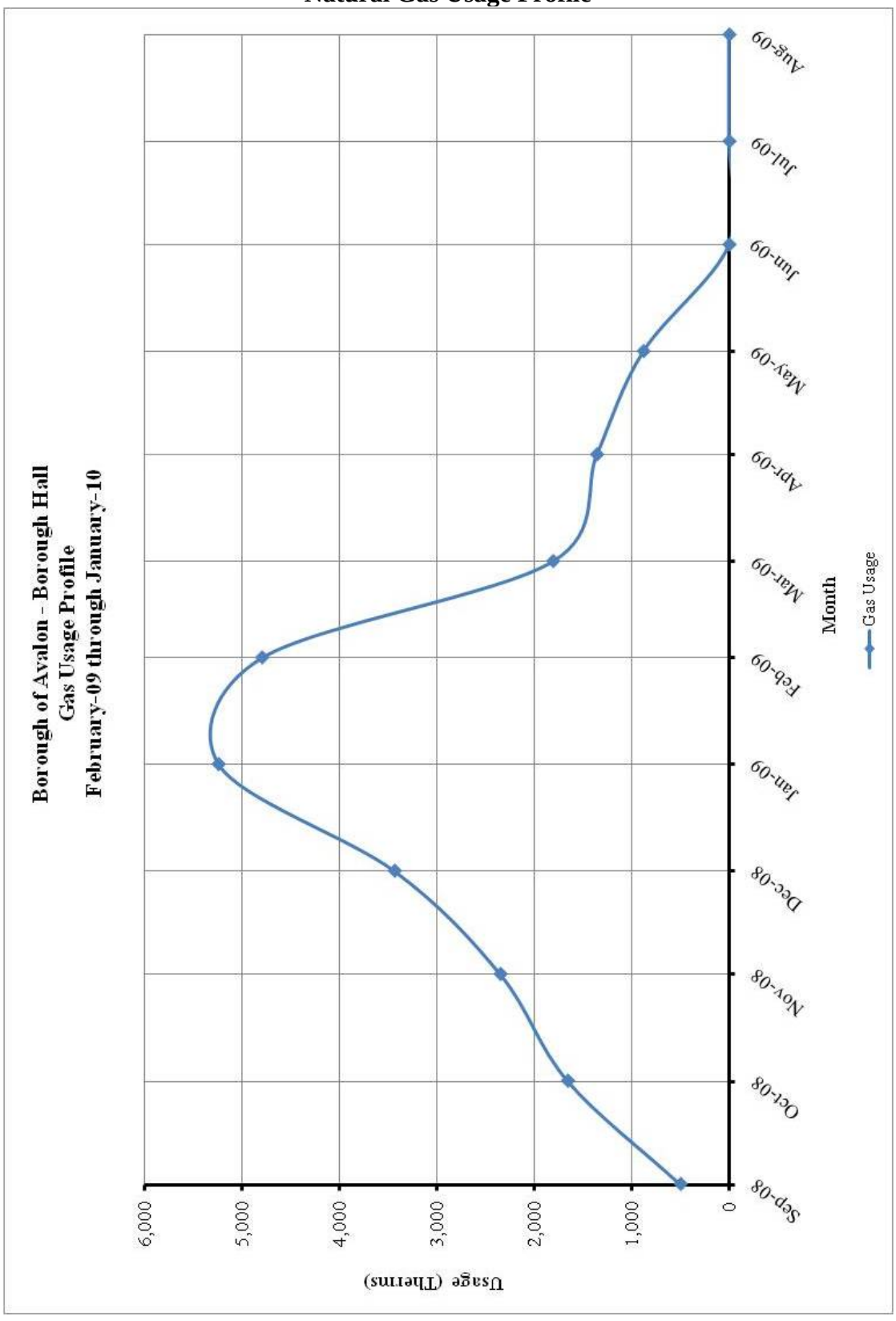


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	South Jersey Gas	
Rate:		
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Sep-08	498	$797
Oct-08	1,654	$2,646
Nov-08	2,345	$3,752
Dec-08	3,430	$5,488
Jan-09	5,235	$8,376
Feb-09	4,789	$7,662
Mar-09	1,806	$2,890
Apr-09	1,356	$2,170
May-09	879	$1,406
Jun-09	0	$0
Jul-09	0	$0
Aug-09	0	$0
TOTALS	**21,992**	**$35,187**
AVERAGE RATE:	**$1.60**	**$/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:

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

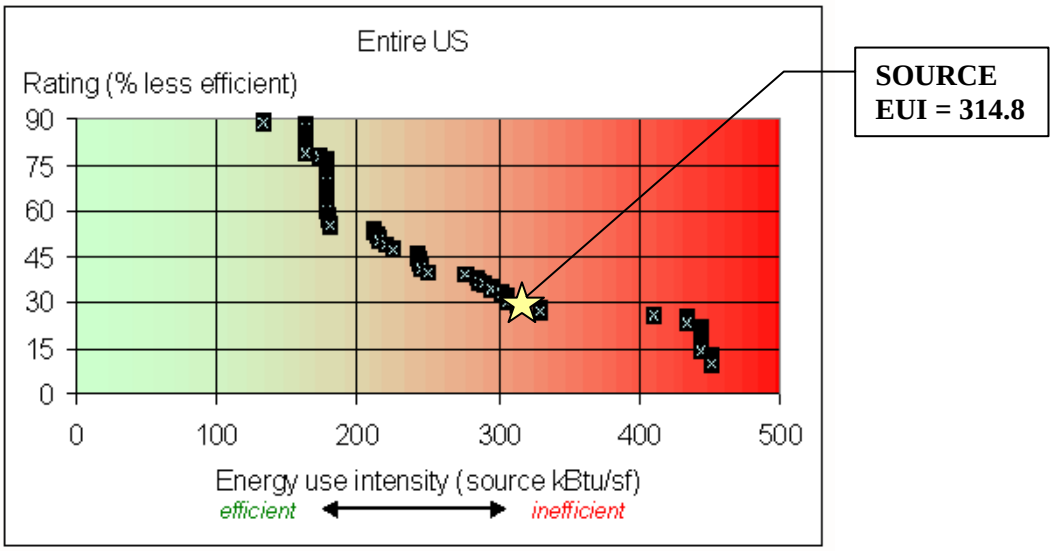
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

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	243434.1			831,084	3.340	2,775,821
NATURAL GAS		21992.0		2,199,200	1.047	2,302,562
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				3,030,284		5,078,383
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		16,132	SQUARE FEET			
BUILDING SITE EUI		*187.84*	kBtu/SF/YR			
BUILDING SOURCE EUI		*314.80*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of *Public Order and Safety Buildings*.

Figure 3
Source Energy Use Intensity Distributions: Public Order Buildings



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**
Borough Hall	5	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 16,132 square foot Avalon Borough Hall consists of administration offices, conference rooms, court room, code compliance spaces, mechanical rooms, janitor closets, restrooms, library/copy room, kitchen, borough clerk, tax assessor/zoning offices, and the senior center. The facility was built in 1980 then expanded in 1996. The building is a block structure with brick siding on a concrete slab foundation and a flat built-up roof with asphalt gravel roof. The 1996 addition demolished the oldest section of the hall and connected the administration wing to the senior citizen center.

Typical hours of operation for this facility are between 8:00 am and 4:30 pm. The court room has night meetings roughly from 7:00 pm to 10:00 pm based on the borough's schedule and is also used for the Borough Council meetings. Exterior walls are brick construction with minimum insulation typical of the time period. The amount of insulation within the wall is unknown. The windows throughout the facility are in good condition and appear to be maintained. Typical windows throughout the facility are double pane, ¼" clear glass with aluminum frames. Blinds are utilized through the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is constructed of a built-up roof with light color stone covering, where all rooftop HVAC equipment is located. The amount of insulation below the roofing is unknown.

HVAC Systems

In June of 2008, five (5) new rooftop air handling units were installed on the roof along with a four-pipe hot & chilled water piping run from the Elementary School central plant. All five air handling units are equipped with demand control ventilation and have CO_2 sensors mounted in the return ductwork to the rooftop units. The air handling system serving the Mayor/Business Admin/Court Clerk/Lounge/Judge rooms (AHU-1) was completely upgraded with new ductwork and ten (10) new VAV single-duct terminal units with hot water heating coils. The other four units are constant volume and were tied into existing supply/return ductwork. The units are as follows:

Unit #	Area Served	Design CFM
AHU-1	Mayor/Business Admin/Court Clerk/Lounge/Judge	4,000
AHU-2	Court Room	4,000
AHU-3	Tax Assessor/Council Chambers/Finance/Boro Clerk	3,400
AHU-4	Zoning/Building Inspection/Restrooms/Lobby/Waiting	3,400
AHU-5	Senior Center/Toilet Rooms/Kitchen	2,400

Entrance vestibules are heated via electric cabinet heaters.

Exhaust System

Air is exhausted from the toilet rooms, corridors, etc. through the roof exhausters. The general and toilet room exhaust fans are operated based on the facility occupancy schedule.

HVAC System Controls

The HVAC systems within the facility are controlled via an Invensys Building System that controls the air handling units hot and chilled water valves, VAV terminal hot water coils, hot water radiation in the storage room, EF-1, secondary hot and chilled water pumps in the Elementary School central plant and a chiller bypass control to maintain minimum flow thru the chiller when the Elementary School is closed for the summer.

Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 40 gallon Bradford White electric hot water heater, capacity of 4,500 Watts. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The circulation pump is controlled by an aqua stat. The domestic hot water piping insulation appears to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube 2x2 and 2x4 lay-in fixtures with T-12 lamps and magnetic ballasts. Storage rooms and closets are lit with a mixture of incandescent lamps and compact fluorescent lamps. Exterior building lighting consists of 100-Watt incandescent globe fixtures, 70-Watt HPS wallpacks, 150-Watt HPS wallpacks, 12 inch circular 100-Watt wall mounts, and 70-Watt ceiling mounted fixtures in the canopy of the main entrance. Approximately 1/4 of the globe fixtures on the sides of the building are on during the day due to lighting controls not functioning properly.

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: Interior Lighting Upgrades (T-12 to Super T-8 Retrofits)

Description:

The Borough Hall is mostly lit by 2x2, 2-lamp & 1x4 & 2x4, 4-lamp & 2-lamp 34-watt T12 fixtures with magnetic ballasts. 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. For example, 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, a 3-lamp retrofit with aluminum reflector and electronic ballast, 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 and aluminum reflectors 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 this facility by half. This is accomplished by "tandem wiring" of ballasts. Rather than using one electronic ballast for every one fixture, one ballast may be used for two or more fixtures.

This ECM includes retrofitting each of the existing T-12 fluorescent lamp and magnetic ballast fixtures with Super T-8 lamps and high-power electronic ballasts including the installation of aluminum reflectors. High efficiency electronic ballasts reduce overall wattage while maintaining the existing lumen levels of the various rooms. 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 or equivalent.

Energy Savings Calculations:

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for retrofit of T-12 fixtures to Super 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 #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$23,640
NJ Smart Start Equipment Incentive ($):	$3,630
Net Installation Cost ($):	$20,010
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,037
Total Yearly Savings ($/Yr):	$2,037
Estimated ECM Lifetime (Yr):	15
Simple Payback	9.8
Simple Lifetime ROI	52.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$30,555
Internal Rate of Return (IRR)	6%
Net Present Value (NPV)	$4,307.57

ECM #2: 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 Borough Hall/Senior Center with the appropriate CFL.

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 #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$80
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$80
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$43
Total Yearly Savings ($/Yr):	$43
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.9
Simple Lifetime ROI	701.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$641
Internal Rate of Return (IRR)	53%
Net Present Value (NPV)	$430.47

ECM #3: Occupancy Sensors

Description:

A common occurrence in many facilities is lighting fixtures being left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs. To better control lighting according to occupancy and reduce lighting energy consumption, CEG recommends installing occupancy sensors. Private offices, file rooms, lounges, kitchens, conference rooms, etc. are good candidates for wall-mounted or ceiling mounted occupancy sensors. Dual technology sensors (ultrasonic and infrared) detect human motion and presence to ensure proper activation of lights. The basis of calculation is the SensorSwitch Model WSD wall switch, Model CM ceiling mount and Daylighting Controls or equivalent.

Energy Savings Calculations:

To determine an estimated savings for lighting controls, CEG used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, the kitchen/lounge, small-sized mechanical rooms, storage rooms, data rooms, file rooms, etc. This energy conservation measure can be applied to eighteen (18) areas throughout the facility which amounts to approximately 4,600 square feet of space. From the lighting survey for this site, CEG calculated the lighting power density (Watts/ft^2) of these areas to be 2.387 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of the occupancy sensors:

10% x 2.387 Watts/SF x 4,600 SF x 2,600 hrs/yr. = 2,856 kWh/year

Annual Energy Savings = 2,856 kWh/yr. x $ 0.129/kWh = $368 / yr

The various types of sensors and quantities are as follows:

Wall Switches	13 Units
Ceiling Mounted Sensors	3 Units
Daylight Sensor/Dimming Ballast	2 Unit

The installed cost of each type of occupancy sensor including dimming ballast, rewiring, relays, J-Boxes, sensors, power packs, on/off photocells, inhibit photocells, etc. is as follows:

Wall Switches	$160/Unit x 13 Units = $2,080
Ceiling Mounted Sensors	$240/Unit x 3 Units = $720
Daylight Sensor/Dimming Ballast	$280/Unit x 2 Unit = $560
	TOTAL COST = $3,360

From the **NJ Smart Start Appendix**, the installation of Occupancy Sensor Remote Mounted (OSR) lighting controls warrants a $35 incentive per control. Eighteen (18) sensors x $35/sensor = $630.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,360
NJ Smart Start Equipment Incentive ($):	$630
Net Installation Cost ($):	$2,730
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$368
Total Yearly Savings ($/Yr):	$368
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.4
Simple Lifetime ROI	102.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$5,520
Internal Rate of Return (IRR)	10%
Net Present Value (NPV)	$1,663.16

ECM #4: Exterior Building Lighting Upgrades

During CEG's site survey, it was noted that in numerous outdoor fixtures are still utilizing incandescent lamps throughout the facility. In addition, the mechanical, pin-type lighting controllers are not functioning properly and ¼ of the fixtures are lit during the day.

This ECM involves replacing the incandescent lamps in the outdoor fixtures with energy efficient compact fluorescent lamps (CFLs). In addition, remote lighting sensors will be installed to control the lighting. The cost of the retrofit CFLs = 19 x $20 = $380. The cost of the Daylight Sensor Remote Mounted (OSR) lighting controls = 19 x $ 280 = $5,320.

Energy Savings Calculations:

There are nineteen (19) exterior building white globe and round white, wall-mounted fixtures with an A19, 100-Watt incandescent lamp. These fixtures are on approximately 4,300 hours per year.

Existing energy usage = 19 fixtures x 100 Watts/fixture x 4,300 hrs/year = 8,170 kWh
Existing annual energy cost = 8,170 kWh x $0.129/kWh = $1,054

Proposed energy usage = 19 fixtures x 26 Watts/fixture x 4,300 hrs/yr = 2,124 kWh

Proposed annual energy cost = 2,124 kWh x $0.129/kWh = $274

Annual cost savings = $1,054 - $274 = $780

From the **NJ Smart Start Appendix**, the installation of Daylight Sensor Remote Mounted (OSR) lighting controls warrants a $35 incentive per control. Nineteen (19) sensors x $35/sensor = $665.

Maintenance savings are from the cost of replacement incandescent lamps (100-Watt, A19 lamp) and the labor to install. CFLs last 10,000 hours while incandescent lamps last approximately 1,200 hours. Therefore, there is a savings of not having to replace lamps eight times during the life of a CFL. There are 19 fixtures that would be replaced 8.3 times within one lifetime of a CFL fixture. Approximate price for lamp replacement for each existing fixture is $5.

Maintenance Savings = 19 Fixtures x 8.3 lamps in one CFL lifetime x $5/ lamp = $789

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,700
NJ Smart Start Equipment Incentive ($):	$665
Net Installation Cost ($):	$5,035
Maintenance Savings ($/Yr):	$789
Energy Savings ($/Yr):	$780
Total Yearly Savings ($/Yr):	$1,569
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.2
Simple Lifetime ROI	367.4%
Simple Lifetime Maintenance Savings	$11,835
Simple Lifetime Savings	$23,535
Internal Rate of Return (IRR)	31%
Net Present Value (NPV)	$13,695.62

ECM #5: Install High-Efficiency Low-E Windows in the Courtroom

Description:

The Courtroom has double-pane, un-insulated windows with aluminum frames which allow heat losses and gains resulting in cooler interior surfaces during the heating season and warmer interior surfaces during the cooling season. In addition, these windows are a source of cold air leakage into the room and often result in condensation-related problems when this cold air contacts warmer surfaces.

High-performance, Low-E windows can provide many benefits including:

- Improved comfort by reducing radiant heat exchange
- Improved indoor air quality by reducing air leakage that can bring dirt, dust, and other impurities into the building
- Lower utility bills since these windows are better insulated and more air-tight
- Fewer condensation problems since these windows stay warmer in the heating season resulting in drier windows
- Reduced wear on furnishings, carpeting, window treatments, etc. since low-e coatings block up to 98 % of the ultraviolet radiation of the sun.

This energy conservation measure would replace these single-pane windows with high performance, low-e window units. CEG measured the Courtroom windows and obtained 180 SF of window area to be retrofitted. The installed cost of these windows is estimated at $100 per square foot x 180 SF = $18,000 (Installation budget cost obtained from a window contractor).

Energy Savings Calculations:

Heating Degree Days (HDD) = 4,806°F – day/yr.

Cooling Degree Days (CDD) = 1,354°F – day/yr.

Total window area to be retrofitted = 180 SF

Uexist. = 0.67 Btu/hr – ft^2 - °F

CEG would recommend replacement of the existing double-pane, un-insulated windows with a commercial window system that meets or exceeds the following performance characteristics: U-Factor = 0.28, Solar Heat Gain Coefficient = 0.21 and Visible Transmittance = 0.49.

Unew = 0.28 Btu/hr – ft^2 - °F

Annual Energy Savings (Heating) =

12 hrs * Window Area * (Uexist-Unew) * HDD

= 12 * 180 * (0.67-0.28) * 4,806 = 40.5 MMBTU = 405 Therms

Energy Savings = 405 Therms x $1.60 = $648

Annual Energy Savings (Cooling) =

12 hrs * Window Area * (Uexist-Unew) * CDD Day

= 12 * 180 * (0.67-0.28) * 1,354 = 11.4 MMBTU x 293.1 kWh / MMBTU = 3,343 kWh

Energy Savings = 3,343 kWh x $0.129/kWh = $431

Total energy savings for this ECM = $ 648 + $ 431 = $ 1,079

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$18,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,079
Total Yearly Savings ($/Yr):	$1,079
Estimated ECM Lifetime (Yr):	25
Simple Payback	16.7
Simple Lifetime ROI	49.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$26,975
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	$788.79

ECM #6: 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 only install low flow high performance sink aerators. The other ECMs discussed above were investigated but the payback periods were longer than 10 years and therefore would not benefit the Owner.

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 Borough Hall are as follows:

Plumbing Fixture	# of Units	Water Cost Savings	Installed Cost	Payback(Yrs.)
Faucet	5	$109	$190	1.74
Urinal	2	$52	$420	8.1
Toilet	6	$83	$1,260	15
	Totals:	$244	$1,870	8.28 Avg.

The basis of calculation for the low flow high performance sink aerator is the UtilitySavers™ high performance Spray Stream.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,790
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,790
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$161
Total Yearly Savings ($/Yr):	$161
Estimated ECM Lifetime (Yr):	10
Simple Payback	11.1
Simple Lifetime ROI	-10.1%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$1,610
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	($416.64)

* ECM Calculations encompass savings for all plumbing fixtures but CEG recommends the implementation of high performance sink aerators and high performance urinals **only**. This is because the faucet replacement and urinal replacement have low payback periods of 1.74 and 8.1 years, respectively. 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). In addition to a photovoltaic rooftop array, CEG has also analyzed the options for a parking lot solar array for the Borough Hall parking lot. 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 the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,100 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 15.64 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 19,107 KWh annually, reducing the overall utility bill by approximately 7.8% 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 space on 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 (Rooftop)	15.38 Years	62.5%	4.6%
Direct Purchase (Car-Port)	12.82 Years	101.9	6.4

*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 Borough Hall 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 Borough Hall 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 Borough Hall has been estimated as this building is fed electric service from the Elementary School and there is no existing sub-metering for the Borough Hall. Based on the estimated profile, there is a relatively consistent electrical load that follows the standard profile based on heating or cooling season. It is hard to predict an accurate profile for the Borough Hall as the heating and cooling for the building is serviced from the Elementary School via an underground piping distribution system.

Natural Gas:

The estimated Natural Gas Usage Profile for the Borough Hall is irregular. This is due to the minimum consumption in the major heating months (Dec through March) and the increase in consumption occurring only in the months of September, October, November and August. As noted above, this profile is estimated as there is no available sub-metering for the Borough Hall from the main distribution located in the Elementary School.

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:

Note: Description below is for the utility tariff charged to the Elementary School by South Jersey Gas Company. Currently, the Elementary School is being serviced their natural gas commodity via South Jersey Energy, as a Third Party Supplier and their natural gas delivery via South Jersey Gas Company.

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 that the Borough of Avalon revive discussions with the Elementary School in regards to utility charges for the Borough's actual use. Possible sub-metering techniques should be explored and implemented in order to gather the correct usage being utilized by the Borough. Until the sub-metering effort and future discussion in regards to billing occurs, the Borough will continue to pay their current charges. Based on the above, CEG cannot provide any recommendations on energy procurement at this time for the Borough Hall.

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.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Borough of Avalon - Borough Hall

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	Interior Lighting Upgrades (T12 to T8 Retrofits)	$23,640	$0	$3,630	$20,010	$2,037	$0	$2,037	15	$30,555	$0	52.7%	9.8	5.83%	$4,307.57
ECM #2	Interior Incandescent Lighting Upgrades	$80	$0	$0	$80	$43	$0	$43	15	$641	$0	701.8%	1.9	53.36%	$430.47
ECM #3	Occupancy Sensors	$3,360	$0	$630	$2,730	$368	$0	$368	15	$5,520	$0	102.2%	7.4	10.44%	$1,663.16
ECM #4	Exterior Building Incandescent Lighting Upgrades	$5,700	$0	$665	$5,035	$780	$789	$1,569	15	$23,535	$11,835	367.4%	3.2	30.59%	$13,695.62
ECM #5	Install High Efficiency Low-E Windows in the Courtroom	$18,000	$0	$0	$18,000	$1,079	$0	$1,079	25	$26,975	$0	49.9%	16.7	3.39%	$788.79
ECM #6	Water Conservation Opportunities	$1,790	$0	$0	$1,790	$161	$0	$161	10	$1,610	$0	-10.1%	11.1	-1.88%	($416.64)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	15.64 KW Rooftop PV System	$140,760	$0	$0	$140,760	$2,465	$6,687	$9,152	25	$228,800	$167,175	62.5%	15.4	4.15%	$18,605.13
REM #2	35.42 KW Parking Lot PV System	$256,650	$0	$0	$256,650	$5,582	$15,145	$20,727	25	$518,175	$378,625	101.9%	12.4	6.34%	$104,272.31
REM #3	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	0.00%	$0.00

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* .

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

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%

STATEMENT OF ENERGY PERFORMANCE
Borough Hall

Building ID: 2241089
For 12-month Period Ending: January 31, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 08, 2010

Facility
Borough Hall
3100 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: 1980
Gross Floor Area (ft²): 16,132

Energy Performance Rating[2] (1-100) 5

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	830,597
Natural Gas (kBtu)[4]	2,199,200
Total Energy (kBtu)	3,029,797

Energy Intensity[5]

Site (kBtu/ft²/yr)	188
Source (kBtu/ft²/yr)	315

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	243

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	98
National Average Source EUI	165
% Difference from National Average Source EUI	91%
Building Type	Office

Stamp of Certifying Professional

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

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.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

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	Borough Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	3100 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		☐
Borough Hall (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	16,132 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	37 (Default)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	35 (Default)	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

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	17,558.00
12/01/2009	12/31/2009	16,760.00
11/01/2009	11/30/2009	19,744.00
10/01/2009	10/31/2009	25,659.00
09/01/2009	09/30/2009	29,372.00
08/01/2009	08/31/2009	30,264.00
07/01/2009	07/31/2009	24,295.00
06/01/2009	06/30/2009	17,550.00
05/01/2009	05/31/2009	15,961.00
04/01/2009	04/30/2009	14,364.00
03/01/2009	03/31/2009	16,023.00
02/01/2009	02/28/2009	15,884.00
Electric Consumption (kWh (thousand Watt-hours))		**243,434.00**
Electric Consumption (kBtu (thousand Btu))		**830,596.81**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**830,596.81**
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	5,235.00
12/01/2009	12/31/2009	3,430.00
11/01/2009	11/30/2009	2,345.00
10/01/2009	10/31/2009	1,654.00
09/01/2009	09/30/2009	498.00
08/01/2009	08/31/2009	0.00
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	0.00
05/01/2009	05/31/2009	879.00
04/01/2009	04/30/2009	1,356.00

03/01/2009	03/31/2009	1,806.00
02/01/2009	02/28/2009	4,789.00
Gas Consumption (therms)		**21,992.00**
Gas Consumption (kBtu (thousand Btu))		**2,199,200.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**2,199,200.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Borough Hall
3100 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

Borough Hall	
Gross Floor Area Excluding Parking: (ft^2)	16,132
Year Built	1980
For 12-month Evaluation Period Ending Date:	January 31, 2010

Facility Space Use Summary

Borough Hall	
Space Type	Office
Gross Floor Area(ft^2)	16,132
Weekly operating hours	40
Workers on Main Shift[d]	37
Number of PCs[d]	35
Percent Cooled	50% or more
Percent Heated	50% or more

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	5	5	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	188	188	73	N/A	98
Source (kBtu/ft^2)	315	315	122	N/A	165
Energy Cost					
$/year	$ 66,590.00	$ 66,590.00	$ 25,826.18	N/A	$ 34,920.66
$/$ft^2$/year	$ 4.13	$ 4.13	$ 1.60	N/A	$ 2.17
Greenhouse Gas Emissions					
$MtCO_2e$/year	243	243	94	N/A	127
$kgCO_2e/ft^2$/year	15	15	6	N/A	8

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

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

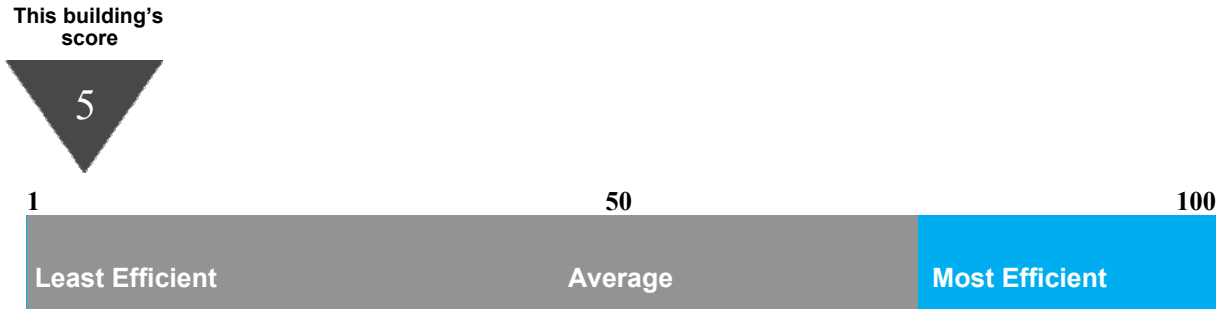
Statement of Energy Performance

2010

Borough Hall
3100 Dune Drive
Avalon, NJ 08202

Portfolio Manager Building ID: 2241089

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit energystar.gov/benchmark.



This building uses 315 kBtu per square foot per year.*

*Based on source energy intensity for the 12 month period ending January 2010

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at energystar.gov

Date of certification

EPA United States Environmental Protection Agency

Date Generated: 04/08/2010

MAJOR EQUIPMENT LIST

Concord Engineering Group

BOROUGH HALL

Rooftop AIR HANDLING UNITS

Tag	AHU-1	AHU-2	AHU-3
Unit Type	Rooftop	Rooftop	Rooftop
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Mayor, Bus Admin, Court Clerk,Lounge, Judge Chamber	Court Room	Tax Assessor, Council Chamber, Finance, Boro Clerk
Manufacturer	Trane	Trane	Trane
Model #	TSCB008U0E	TSCB014U0E	TSCB008U0E
Design CFM	4,000	7,000 (4,000)	3,400
S/A Fan	7.5 (VFD)	10	5
Approx Age	1	1	1
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

Rooftop AIR HANDLING UNITS (CONTINUED)

Tag	AHU-4	AHU-5
Unit Type	Rooftop	Rooftop
Qty	1	1
Location	Roof	Roof
Area Served	Zoning, Bldg Inspections, Restrooms, Lobby, Waiting Rm	Senior Center, Toilet Rms, Kitchen
Manufacturer	Trane	Trane
Model #	TSCB008U0E	TSCB006U0E
Design CFM	3,400	2,400
S/A Fan	5	2
Approx Age	1	1
Ashrae Service Life	20	20
Remaining Life	19	19
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

BOROUGH HALL

Domestic Hot Water Heaters		
Unit Type	DHW Heater	DHW Heater
Qty	1	1
Location	Mech Room	Closet
Area Served	Borough Hall	Senior Center
Manufacturer	Bradford White	
Model #	M-I-40T6DS13	
Serial #	WF9896491	
Size (Gallons)	40	
Input Capacity (MBH/KW)	4,500 kW	
Fuel	Electric	
Approx Age	12	
Ashrae Service Life	13	
Remaining Life	1	
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

BOROUGH HALL

Exhaust Fans			
Tag	**EF-1**	**EF-2**	**EF-3**
Unit Type	Roof Exhaust	Roof Exhaust	Roof Exhaust
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Boro Hall - Toilet Exhaust	Boro Hall - General Exhaust	Senior Center - Toilet Exhaust
Manufacturer	Greenheck		
Model #	GB-121-4		
Fan HP	0.25	NO UNIT TAG	NO UNIT TAG
Fan CFM	800		
Approx Age	1	14	14
Ashrae Service Life	20	20	20
Remaining Life	19	19	19
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

BOROUGH HALL

VAV TERMINAL UNITS - PERFORMANCE DATA

TAG #	Design Airflow (CFM)	HW Coil Capacity (MBH)
VV-1	450	14
VV-2	440	11.6
VV-3	385	12
VV-4	450	11.1
VV-5	360	11.6
VV-6	470	11.6
VV-7	150	7.8
VV-8	400	12
VV-9	190	7.8
	TOTAL MBH:	99.5
Comments		

MAJOR EQUIPMENT LIST

Concord Engineering Group

BOROUGH HALL

Electric Cabinet Heaters		
Tag	**CUH-1**	**CUH-2, 3**
Unit Type	Ceiling	Ceiling
Qty	1	2
Location	Back Entrance Vestibule	Front Entrance Vestibule
Area Served	Back Entrance Vestibule	Front Entrance Vestibule
Manufacturer	-	-
Model #	-	-
kW INPUT	4,000 Watts	4,000 Watts
Fuel	Electric	Electric
Electrical Power	240 Volts	240 Volts
Approx Age	14	14
Ashrae Service Life	15	15
Remaining Life	1	1
Comments		

Investment Grade Lighting Audit

CEG Job #: 9C09187
Project: Avalon Boro Energy Audit
Address: 3100 Dune Drive
Avalon, NJ
Building SF: 16,132

"Borough Hall"

KWH COST: $0.129

ECM #1: 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
					Boro Hall																	
111.21	Entrance	2600	2	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	40	0.08	208.0	$26.83	2	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	0.06	156	$20.12	$80.00	$160.00	0.02	52	$6.71	23.85
142.21	119 Admin. Assistant Office	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$57.69	$100.00	$200.00	0.12	301.6	$38.91	5.14
142.21	118 Mayor's Office	2600	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.43	1,123.2	$144.89	3	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.26	670.8	$86.53	$100.00	$300.00	0.17	452.4	$58.36	5.14
555		2600	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	338.0	$43.60	2	1	26w CFL Lamp	26	0.05	135.2	$17.44	$20.00	$40.00	0.08	202.8	$26.16	1.53
142.21	117 Lounge	2600	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.43	1,123.2	$144.89	3	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.26	670.8	$86.53	$100.00	$300.00	0.17	452.4	$58.36	5.14
555		2600	1	1	Recessed Down Light, 65w BR30 Lamp	65	0.07	169.0	$21.80	1	1	26w CFL Lamp	26	0.03	67.6	$8.72	$20.00	$20.00	0.04	101.4	$13.08	1.53
142.14	Janitor's Closet	650	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	144	0.14	93.6	$12.07	1	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.09	55.9	$7.21	$100.00	$100.00	0.06	37.7	$4.86	20.56
620	Mechanical Room	650	1	1	Wall Mnt. "Jelly Jar", (1) 75w A19 Lamp	60	0.06	39.0	$5.03	1	1	(1) 18w CFL Lamp	18	0.02	11.7	$1.51	$20.00	$20.00	0.04	27.3	$3.52	5.68
142.21	Assist. To Administrator	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$57.69	$100.00	$200.00	0.12	301.6	$38.91	5.14
142.21	Administrator's Office	2600	4	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.58	1,497.6	$193.19	4	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.34	894.4	$115.38	$100.00	$400.00	0.23	603.2	$77.81	5.14
142.21	122 Conference Room	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$57.69	$100.00	$200.00	0.12	301.6	$38.91	5.14
142.21	123 Violation's Bureau	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$57.69	$100.00	$200.00	0.12	301.6	$38.91	5.14
122.21	Lobby	3000	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	450.0	$58.05	2	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	348	$44.89	$100.00	$200.00	0.03	102	$13.16	15.20
122.21	Office	2600	9	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.68	1,755.0	$226.40	9	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.52	1357.2	$175.08	$100.00	$900.00	0.15	397.8	$51.32	17.54

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122.21	125 Judge's Office	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.17	452.4	$58.36	$100.00	$300.00	0.05	132.6	$17.11	17.54
127.21	125 Restroom	650	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	30.55	$3.94	$100.00	$100.00	0.02	13.65	$1.76	56.79
121.31	Storage	650	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	88.4	$11.40	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	75.4	$9.73	$100.00	$200.00	0.02	13	$1.68	119.26
142.22	Courtroom	3000	21	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Parabolic Lens	144	3.02	9,072.0	$1,170.29	21	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	1.81	5418	$698.92	$100.00	$2,100.00	1.22	3654	$471.37	4.46
111.14	Cove Lighting - Courtroom	3000	38	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., No Lens	40	1.52	4,560.0	$588.24	38	1	1 Lamp, 32w T8, Elect. Ballast; retrofit	30	1.14	3420	$441.18	$80.00	$3,040.00	0.38	1140	$147.06	20.67
122.21	105 Construction Office	2600	10	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.75	1,950.0	$251.55	10	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.58	1508	$194.53	$100.00	$1,000.00	0.17	442	$57.02	17.54
122.21	Construction Official	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.23	603.2	$77.81	$100.00	$400.00	0.07	176.8	$22.81	17.54
122.21	Inspector's Room	2600	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.45	1,170.0	$150.93	6	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.35	904.8	$116.72	$100.00	$600.00	0.10	265.2	$34.21	17.54
126.45		2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	2	6'x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.12	301.6	$38.91	$140.00	$280.00	0.03	88.4	$11.40	24.55
122.21	File Room	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.17	452.4	$58.36	$100.00	$300.00	0.05	132.6	$17.11	17.54
121.21	Roof Access	650	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.06	37.7	$4.86	$100.00	$100.00	0.01	6.5	$0.84	119.26
122.21	Code Enforcement	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$38.91	$100.00	$200.00	0.03	88.4	$11.40	17.54
127.21	Women's Restroom	2600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	176.8	$22.81	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	122.2	$15.76	$100.00	$100.00	0.02	54.6	$7.04	14.20
127.21	Men's Restroom	2600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	176.8	$22.81	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	122.2	$15.76	$100.00	$100.00	0.02	54.6	$7.04	14.20
127.21	Lobby	3000	5	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.34	1,020.0	$131.58	5	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.24	705	$90.95	$100.00	$500.00	0.11	315	$40.64	12.30
127.21	Hall	3000	11	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.75	2,244.0	$289.48	11	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.52	1551	$200.08	$100.00	$1,100.00	0.23	693	$89.40	12.30

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121.21	Men's Restroom	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	353.6	$45.61	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$38.91	$100.00	$200.00	0.02	52	$6.71	29.82
126.45		2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	2	6'x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.12	301.6	$38.91	$140.00	$280.00	0.03	88.4	$11.40	24.55
121.21	Women's Restroom	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	353.6	$45.61	2	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$38.91	$100.00	$200.00	0.02	52	$6.71	29.82
126.45		2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	2	6'x4, 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., White Diffuser	58	0.12	301.6	$38.91	$140.00	$280.00	0.03	88.4	$11.40	24.55
Tax Office and Clerk																					
121.21	Copy Room	2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.34	884.0	$114.04	5	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.29	754	$97.27	$100.00	$500.00	0.05	130	$16.77	29.82
121.21	File Room	2600	9	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.61	1,591.2	$205.26	9	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.52	1357.2	$175.08	$100.00	$900.00	0.09	234	$30.19	29.82
121.21	Storage	650	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.06	37.7	$4.86	$100.00	$100.00	0.01	6.5	$0.84	119.26
122.21	Treasurer's Offices	2600	5	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.38	975.0	$125.78	5	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.29	754	$97.27	$100.00	$500.00	0.09	221	$28.51	17.54
142.22	106 Computer Room	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Parabolic Lens	144	0.29	748.8	$96.60	2	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	0.17	447.2	$57.69	$100.00	$200.00	0.12	301.6	$38.91	5.14
122.21	Treasurer	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.23	603.2	$77.81	$100.00	$400.00	0.07	176.8	$22.81	17.54
122.21	Clerk's Assist. Office	2600	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.45	1,170.0	$150.93	6	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.35	904.8	$116.72	$100.00	$600.00	0.10	265.2	$34.21	17.54
122.21	Clerk's Office	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.23	603.2	$77.81	$100.00	$400.00	0.07	176.8	$22.81	17.54
122.21	Tax Collector's Office	2600	7	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.53	1,365.0	$176.09	7	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.41	1055.6	$136.17	$100.00	$700.00	0.12	309.4	$39.91	17.54
121.11	Safe	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.27	707.2	$91.23	4	2	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.23	603.2	$77.81	$100.00	$400.00	0.04	104	$13.42	29.82
122.21	Tax Collector	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$38.91	$100.00	$200.00	0.03	88.4	$11.40	17.54
122.21	108 Tax Assessor	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.12	301.6	$38.91	$100.00	$200.00	0.03	88.4	$11.40	17.54

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122.21	108A Tax Assessor	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	1	2 Lamp, 32w T8, Elect. Ballast; retrofit	58	0.17	452.4	$58.36	$100.00	$300.00	0.05	132.6	$17.11	17.54
127.21	Hall	3000	6	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.41	1,224.0	$157.90	6	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.28	846	$109.13	$100.00	$600.00	0.13	378	$48.76	12.30
127.21		3000	2	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.14	408.0	$52.63	2	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.09	282	$36.38	$100.00	$200.00	0.04	126	$16.25	12.30
					Senior Center																	
142.21	Day Room	1600	21	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	3.02	4,838.4	$624.15	21	3	3 Lamp , 32w T8, Elect. Ballast; retrofit	86	1.81	2889.6	$372.76	$100.00	$2,100.00	1.22	1948.8	$251.40	8.35
127.21	Storage	650	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	30.55	$3.94	$100.00	$100.00	0.02	13.65	$1.76	56.79
127.21	Lobby	1600	2	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.14	217.6	$28.07	2	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.09	150.4	$19.40	$100.00	$200.00	0.04	67.2	$8.67	23.07
127.21	Kitchen	1600	3	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.20	326.4	$42.11	3	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.14	225.6	$29.10	$100.00	$300.00	0.06	100.8	$13.00	23.07
127.21	Men's Restroom	1600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	108.8	$14.04	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	75.2	$9.70	$100.00	$100.00	0.02	33.6	$4.33	23.07
127.21	Women's Restroom	1600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	108.8	$14.04	1	3	3 Lamp, 17w T8, Elect. Ballast; retorfit	47	0.05	75.2	$9.70	$100.00	$100.00	0.02	33.6	$4.33	23.07
					Exterior																	
621	Exterior	4300	2	1	12" Round White Wall Mnt., (1) 100w A19 Lamp	100	0.20	860.0	$110.94	2	1	(1) 26w CFL Lamp	26	0.05	223.6	$28.84	$20.00	$40.00	0.15	636.4	$82.10	0.49
629		4300	3	1	70w HPS Wallpack	92	0.28	1,186.8	$153.10	3	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
631		4300	1	1	150w HPS Wallpack	188	0.19	808.4	$104.28	1	0	No Change	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
622		4300	17	1	Arm Mnt. White Globe, (1) 100w A19 Lamp	100	1.70	7,310.0	$942.99	17	1	(1) 26w CFL Lamp	26	0.44	1900.6	$245.18	$20.00	$340.00	1.26	5409.4	$697.81	0.49
	Totals		269	131		5119	23.29	62,407.2	$8,050.53	269	114			14.885	38243.3	$4,933.39		$24,100.00	7.94	22168.7	$2,859.76	8.43

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

CEG Job #: 9C09187
Project: Avalon Boro Energy Audit
Address: 3100 Dune Drive
Avalon, NJ
Building SF: 16132

"Borough Hall"

KWH COST: $0.129

ECM #2: Lighting Controls

EXISTING LIGHTING										PROPOSED LIGHTING CONTROLS										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. Cont.	Controls Description	Watts Used	Total kW	Reduction (%)	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
					Boro Hall																		
111.21	Entrance	2600	2	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	40	0.08	208.0	$26.83	2	0	No Change	40	0.08	0%	208	$26.83	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	119 Admin. Assistant Office	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	0	No Change	144	0.29	0%	748.8	$96.60	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	118 Mayor's Office	2600	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.43	1,123.2	$144.89	3	1	Dual Technology Occupancy Sensor	144	0.43	10%	1010.88	$130.40	$160.00	$160.00	0.00	112.32	$14.49	11.04
555	0	2600	2	1	Recessed Down Light, 65w BR30 Lamp	65	0.13	338.0	$43.60	2	0	No Change	65	0.13	0%	338	$43.60	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	117 Lounge	2600	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.43	1,123.2	$144.89	3	0	No Change	144	0.43	0%	1123.2	$144.89	$0.00	$0.00	0.00	0	$0.00	0.00
555	0	2600	1	1	Recessed Down Light, 65w BR30 Lamp	65	0.07	169.0	$21.80	1	0	No Change	65	0.07	0%	169	$21.80	$0.00	$0.00	0.00	0	$0.00	0.00
142.14	Janitor's Closet	650	1	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., No Lens	144	0.14	93.6	$12.07	1	0	No Change	144	0.14	0%	93.6	$12.07	$0.00	$0.00	0.00	0	$0.00	0.00
620	Mechanical Room	650	1	1	Wall Mnt. "Jelly Jar", (1) 75w A19 Lamp	60	0.06	39.0	$5.03	1	0	No Change	60	0.06	0%	39	$5.03	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	Assist. To Administrator	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	1	Dual Technology Occupancy Sensor	144	0.29	10%	673.92	$86.94	$160.00	$160.00	0.00	74.88	$9.66	16.56
142.21	Administrator's Office	2600	4	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.58	1,497.6	$193.19	4	1	Dual Technology Occupancy Sensor	144	0.58	10%	1347.84	$173.87	$160.00	$160.00	0.00	149.76	$19.32	8.28
142.21	122 Conference Room	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	1	Dual Technology Occupancy Sensor	144	0.29	10%	673.92	$86.94	$240.00	$240.00	0.00	74.88	$9.66	24.85

142.21	123 Violation's Bureau	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	0.29	748.8	$96.60	2	0	No Change	144	0.29	0%	748.8	$96.60	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Lobby	3000	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	450.0	$58.05	2	0	No Change	75	0.15	0%	450	$58.05	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Office	2600	9	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.68	1,755.0	$226.40	9	0	No Change	75	0.68	0%	1755	$226.40	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	125 Judge's Office	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	1	Dual Technology Occupancy Sensor	75	0.23	10%	526.5	$67.92	$160.00	$160.00	0.00	58.5	$7.55	21.20
127.21	125 Restroom	650	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	0	No Change	68	0.07	0%	44.2	$5.70	$0.00	$0.00	0.00	0	$0.00	0.00
121.31	Storage	650	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	88.4	$11.40	2	0	No Change	68	0.14	0%	88.4	$11.40	$0.00	$0.00	0.00	0	$0.00	0.00
142.22	Courtroom	3000	21	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Parabolic Lens	144	3.02	9,072.0	$1,170.29	21	1	Dual Technology Occupancy Sensor	144	3.02	10%	8164.8	$1,053.26	$240.00	$240.00	0.00	907.2	$117.03	2.05
111.14	Cove Lighting - Courtroom	3000	38	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., No Lens	40	1.52	4,560.0	$588.24	38	1	Dual Technology Occupancy Sensor	40	1.52	10%	4104	$529.42	$240.00	$240.00	0.00	456	$58.82	4.08
122.21	105 Construction Office	2600	10	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.75	1,950.0	$251.55	10	0	No Change	75	0.75	0%	1950	$251.55	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Construction Official	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	Dual Technology Occupancy Sensor	75	0.30	10%	702	$90.56	$160.00	$160.00	0.00	78	$10.06	15.90
122.21	Inspector's Room	2600	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.45	1,170.0	$150.93	6	1	Dual Technology Occupancy Sensor	75	0.45	10%	1053	$135.84	$160.00	$160.00	0.00	117	$15.09	10.60
126.45	0	2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	File Room	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	0	No Change	75	0.23	0%	585	$75.47	$0.00	$0.00	0.00	0	$0.00	0.00

121.21	Roof Access	650	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	0	No Change	68	0.07	0%	44.2	$5.70	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Code Enforcement	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Women's Restroom	2600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	176.8	$22.81	1	0	No Change	68	0.07	0%	176.8	$22.81	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Men's Restroom	2600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	176.8	$22.81	1	0	No Change	68	0.07	0%	176.8	$22.81	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Lobby	3000	5	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.34	1,020.0	$131.58	5	1	Daylight Sensor	68	0.34	10%	918	$118.42	$280.00	$280.00	0.00	102	$13.16	21.28
127.21	Hall	3000	11	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.75	2,244.0	$289.48	11	0	No Change	68	0.75	0%	2244	$289.48	$0.00	$0.00	0.00	0	$0.00	0.00
121.21	Men's Restroom	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	353.6	$45.61	2	0	No Change	68	0.14	0%	353.6	$45.61	$0.00	$0.00	0.00	0	$0.00	0.00
126.45	0	2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
121.21	Women's Restroom	2600	2	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.14	353.6	$45.61	2	0	No Change	68	0.14	0%	353.6	$45.61	$0.00	$0.00	0.00	0	$0.00	0.00
126.45	0	2600	2	2	6"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
				Tax Office and Clerk Office																			
121.21	Copy Room	2600	5	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.34	884.0	$114.04	5	1	Dual Technology Occupancy Sensor	68	0.34	10%	795.6	$102.63	$160.00	$160.00	0.00	88.4	$11.40	14.03
121.21	File Room	2600	9	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.61	1,591.2	$205.26	9	1	Dual Technology Occupancy Sensor	68	0.61	10%	1432.08	$184.74	$160.00	$160.00	0.00	159.12	$20.53	7.79
121.21	Storage	650	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	0	No Change	68	0.07	0%	44.2	$5.70	$0.00	$0.00	0.00	0	$0.00	0.00

122.21	Treasurer's Offices	2600	5	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.38	975.0	$125.78	5	0	No Change	75	0.38	0%	975	$125.78	$0.00	$0.00	0.00	0	$0.00	0.00
142.22	106 Computer Room	2600	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Parabolic Lens	144	0.29	748.8	$96.60	2	1	Dual Technology Occupancy Sensor	144	0.29	10%	673.92	$86.94	$160.00	$160.00	0.00	74.88	$9.66	16.56
122.21	Treasurer	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	Dual Technology Occupancy Sensor	75	0.30	10%	702	$90.56	$160.00	$160.00	0.00	78	$10.06	15.90
122.21	Clerk's Assist. Office	2600	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.45	1,170.0	$150.93	6	0	No Change	75	0.45	0%	1170	$150.93	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	Clerk's Office	2600	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.30	780.0	$100.62	4	1	Dual Technology Occupancy Sensor	75	0.30	10%	702	$90.56	$160.00	$160.00	0.00	78	$10.06	15.90
122.21	Tax Collector's Office	2600	7	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.53	1,365.0	$176.09	7	1	Dual Technology Occupancy Sensor	75	0.53	10%	1228.5	$158.48	$160.00	$160.00	0.00	136.5	$17.61	9.09
121.11	Safe	2600	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Pendant Mnt., Prismatic Lens	68	0.27	707.2	$91.23	4	1	Dual Technology Occupancy Sensor	68	0.27	10%	636.48	$82.11	$160.00	$160.00	0.00	70.72	$9.12	17.54
122.21	Tax Collector	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	108 Tax Assessor	2600	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.15	390.0	$50.31	2	0	No Change	75	0.15	0%	390	$50.31	$0.00	$0.00	0.00	0	$0.00	0.00
122.21	108A Tax Assessor	2600	3	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	75	0.23	585.0	$75.47	3	0	No Change	75	0.23	0%	585	$75.47	$160.00	$0.00	0.00	0	$0.00	0.00
127.21	Hall	3000	6	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.41	1,224.0	$157.90	6	0	No Change	68	0.41	0%	1224	$157.90	$0.00	$0.00	0.00	0	$0.00	0.00
127.21		3000	2	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.14	408.0	$52.63	2	1	Daylight Sensor	68	0.14	10%	367.2	$47.37	$280.00	$280.00	0.00	40.8	$5.26	53.20
					Senior Center																	
142.21	Day Room	1600	21	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	144	3.02	4,838.4	$624.15	21	0	No Change	144	3.02	0%	4838.4	$624.15	$0.00	$0.00	0.00	0	$0.00	0.00

127.21	Storage	650	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	44.2	$5.70	1	0	No Change	68	0.07	0%	44.2	$5.70	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Lobby	1600	2	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.14	217.6	$28.07	2	0	No Change	68	0.14	0%	217.6	$28.07	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Kitchen	1600	3	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.20	326.4	$42.11	3	0	No Change	68	0.20	0%	326.4	$42.11	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Men's Restroom	1600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	108.8	$14.04	1	0	No Change	68	0.07	0%	108.8	$14.04	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Women's Restroom	1600	1	2	2x2, 2 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	68	0.07	108.8	$14.04	1	0	No Change	68	0.07	0%	108.8	$14.04	$0.00	$0.00	0.00	0	$0.00	0.00
					Exterior																	
621	Exterior	4300	2	1	12" Round White Wall Mnt., (1) 100w A19 Lamp	100	0.20	860.0	$110.94	2	0	No Change	100	0.20	0%	860	$110.94	$0.00	$0.00	0.00	0	$0.00	0.00
629	0	4300	3	1	70w HPS Wallpack	92	0.28	1,186.8	$153.10	3	0	No Change	92	0.28	0%	1186.8	$153.10	$0.00	$0.00	0.00	0	$0.00	0.00
631	0	4300	1	1	150w HPS Wallpack	188	0.19	808.4	$104.28	1	0	No Change	188	0.19	0%	808.4	$104.28	$0.00	$0.00	0.00	0	$0.00	0.00
622	0	4300	17	1	Arm Mnt. White Globe, (1) 100w A19 Lamp	100	1.70	7,310.0	$942.99	17	0	No Change	100	1.70	0%	7310	$942.99	$0.00	$0.00	0.00	0	$0.00	0.00
0	Totals	0	269	131	0	5119	23.29	62,407.2	$8,050.53	269	18		5119	23.29		59550.24	$7,681.98		$3,360.00	0.00	2856.96	$368.55	9.12

Project Name: LGEA Solar PV Project - Borough Hall (Rooftop Solar Option A)
Location: Avalon, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$140,760
Annual kWh Production	19,107
Annual Energy Cost Reduction	$2,465
Annual SREC Revenue	$6,687
First Cost Premium	**$140,760**
Simple Payback:	**15.38** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.129**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$140,760	0	0	0	$0	(140,760)	0
1	$0	19,107	$2,465	$0	$6,687	$9,152	($131,608)
2	$0	19,011	$2,539	$0	$6,654	$9,193	($122,415)
3	$0	18,916	$2,615	$0	$6,621	$9,236	($113,179)
4	$0	18,822	$2,693	$0	$6,588	$9,281	($103,898)
5	$0	18,728	$2,774	$193	$6,555	$9,136	($94,762)
6	$0	18,634	$2,857	$192	$6,522	$9,187	($85,575)
7	$0	18,541	$2,943	$191	$6,489	$9,241	($76,334)
8	$0	18,448	$3,031	$190	$6,457	$9,298	($67,035)
9	$0	18,356	$3,122	$189	$6,425	$9,358	($57,677)
10	$0	18,264	$3,216	$188	$6,392	$9,420	($48,257)
11	$0	18,173	$3,312	$187	$6,361	$9,486	($38,771)
12	$0	18,082	$3,412	$186	$6,329	$9,554	($29,217)
13	$0	17,992	$3,514	$185	$6,297	$9,626	($19,591)
14	$0	17,902	$3,620	$184	$6,266	$9,701	($9,890)
15	$0	17,812	$3,728	$183	$6,234	$9,779	($111)
16	$0	17,723	$3,840	$183	$6,203	$9,861	$9,749
17	$0	17,634	$3,955	$182	$6,172	$9,946	$19,695
18	$0	17,546	$4,074	$181	$6,141	$10,034	$29,730
19	$0	17,459	$4,196	$180	$6,110	$10,127	$39,856
20	$0	17,371	$4,322	$179	$6,080	$10,223	$50,079
21	$1	17,284	$4,452	$178	$6,050	$10,323	$60,403
22	$2	17,198	$4,585	$177	$6,019	$10,427	$70,830
23	$3	17,112	$4,723	$176	$5,989	$10,536	$81,366
24	$4	17,026	$4,865	$175	$5,959	$10,648	$92,014
25	$5	16,941	$5,010	$174	$5,929	$10,765	$102,780
	Totals:	450,084	$89,865	$3,855	$157,529	$243,540	($441,819)
				Net Present Value (NPV)		**$102,805**	
				Internal Rate of Return (IRR)		**4.6%**	

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
Borough Hall	1100	Sunpower SPR230	68	14.7	1,000	15.64	19,107	2,244	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:	15.6 kW
DC to AC Derate Factor:	0.810
AC Rating:	12.7 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.1 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	1016	1.31
2	3.33	1200	1.55
3	4.31	1675	2.16
4	5.20	1908	2.46
5	5.85	2180	2.81
6	6.14	2122	2.74
7	6.06	2143	2.76
8	5.54	1970	2.54
9	4.85	1693	2.18
10	3.76	1383	1.78
11	2.65	969	1.25
12	2.23	848	1.09
Year	4.38	19107	24.65

.= Proposed PV Layout

Notes:

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

Project Name: LGEA Solar PV Project - Borough Hall (Parking Lot Solar Option B)
Location: Avalon, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$265,650
Annual kWh Production	43,271
Annual Energy Cost Reduction	$5,582
Annual SREC Revenue	$15,145
First Cost Premium	**$265,650**
Simple Payback:	**12.82** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.129**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$265,650	0	0	0	$0	(265,650)	0
1	$0	43,271	$5,582	$0	$15,145	$20,727	($244,923)
2	$0	43,055	$5,749	$0	$15,069	$20,819	($224,105)
3	$0	42,839	$5,922	$0	$14,994	$20,916	($203,189)
4	$0	42,625	$6,100	$0	$14,919	$21,018	($182,171)
5	$0	42,412	$6,283	$437	$14,844	$20,690	($161,481)
6	$0	42,200	$6,471	$435	$14,770	$20,806	($140,674)
7	$0	41,989	$6,665	$432	$14,696	$20,929	($119,746)
8	$0	41,779	$6,865	$430	$14,623	$21,057	($98,688)
9	$0	41,570	$7,071	$428	$14,550	$21,192	($77,496)
10	$0	41,362	$7,283	$426	$14,477	$21,334	($56,162)
11	$0	41,155	$7,502	$424	$14,404	$21,482	($34,679)
12	$0	40,950	$7,727	$422	$14,332	$21,637	($13,042)
13	$0	40,745	$7,959	$420	$14,261	$21,800	$8,757
14	$0	40,541	$8,197	$418	$14,189	$21,969	$30,727
15	$0	40,339	$8,443	$415	$14,118	$22,146	$52,873
16	$0	40,137	$8,697	$413	$14,048	$22,331	$75,204
17	$0	39,936	$8,957	$411	$13,978	$22,524	$97,728
18	$0	39,736	$9,226	$409	$13,908	$22,725	$120,452
19	$0	39,538	$9,503	$407	$13,838	$22,934	$143,386
20	$0	39,340	$9,788	$405	$13,769	$23,152	$166,538
21	$1	39,143	$10,082	$403	$13,700	$23,379	$189,917
22	$2	38,948	$10,384	$401	$13,632	$23,615	$213,531
23	$3	38,753	$10,696	$399	$13,564	$23,860	$237,391
24	$4	38,559	$11,016	$397	$13,496	$24,115	$261,506
25	$5	38,366	$11,347	$395	$13,428	$24,380	$285,886
Totals:		1,019,290	$203,514	$8,729	$356,751	$551,536	$327,541
				Net Present Value (NPV)		**$285,911**	
				Internal Rate of Return (IRR)		**6.4%**	

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
Borough Hall	2500	Sunpower SPR230	154	14.7	2,264	35.42	43,271	5,082	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:	35.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	28.7 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	0.1 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	2301	2.97
2	3.33	2717	3.50
3	4.31	3794	4.89
4	5.20	4322	5.58
5	5.85	4936	6.37
6	6.14	4805	6.20
7	6.06	4854	6.26
8	5.54	4460	5.75
9	4.85	3835	4.95
10	3.76	3132	4.04
11	2.65	2194	2.83
12	2.23	1921	2.48
Year	4.38	43271	55.82

.= Proposed PV Layout

Notes:

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

Energy-Efficient Products
- Federal Requirements
- 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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EERE Information Center
Programs and Offices

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	1.6	$/therm	*0.60 $/therm*	*0.60 $/therm*
Electricity Cost	.129	$/kWh	*0.06 $/kWh*	*0.06 $/kWh*
Minutes per Day of Operation	30	minutes	*30 minutes*	*20 minutes*
Days per Year of Operation	240	days	*260 days*	*365 days*
Quantity to be Purchased	5	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	7200 gal	15840	14400	10800	3600
Annual Water Cost	$ 39	$ 86	$ 78	$ 58	$ 19
Lifetime Water Cost	$ 328	$ 722	$ 655	$ 487	$ 160
WITH ELECTRIC WATER HEATING					
Annual Energy Use	407 kWh	895	814	610	203
Annual Energy Cost	$ 53	$ 115	$ 105	$ 79	$ 26
Lifetime Energy Cost	$ 412	$ 905	$ 823	$ 617	$ 205
Lifetime Energy and Water Cost Savings	$ 887	$ 0	$ 149	$ 523	$ 1262
Lifetime Energy and Water Cost Savings for 5 Faucet(s)	$ 4435	$ 0	$ 745	$ 2615	$ 6310
WITH GAS WATER HEATING					
Annual Energy Use	23 therms	50	45	34	11
Annual Energy Cost	$ 37	$ 80	$ 72	$ 54	$ 18
Lifetime Energy Cost	$ 307	$ 664	$ 598	$ 448	$ 149
Lifetime Energy and Water Cost Savings	$ 751	$ 0	$ 133	$ 451	$ 1077
Lifetime Energy and Water Cost Savings for 5 Faucet(s)	$ 3755	$ 0	$ 665	$ 2255	$ 5385

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 $ 887 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 $ 751 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. Best Available with Water Use Only Form Labels Gallons per minute based on best available levels, for water use only. Annual water use based on best available levels, for water use only. Annual water cost based on best available levels, for water use only. Lifetime water cost based on best available levels, for water use only. Self Closing Faucet with Water Use Only Form Labels Gallons per minute based on self closing faucet, measured in gallon per cycle, for water use only. Annual water use based on self closing faucet, measured in gallon per cycle, for water use only. Annual water cost based on self closing faucet, measured in gallon per cycle, for water use only. Lifetime water cost based on self closing faucet, measured in gallon per cycle, for water use only. Your Choice with Electric Water Heating Form Labels Annual energy use, based on your choice and measured in kilowatt hour, for water use with electric water heating. Annual energy cost, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy cost, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on your choice and measured in dollars, for water use with electric water heating. Base Model with Electric Water Heating Form Labels Annual energy use, based on the base model and measured in dollars, for water use with electric water heating. Annual energy cost, based on the base model and measured in dollars, for water use with electric water heating. Lifetime energy cost, based on the base model and measured in dollars, for water use with electric water heating. 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Self Closing Faucet with Electric Water Heating Form Labels Annual energy use, based on self closing faucet and measured in dollars, for water use with electric water heating. Annual energy cost, based on self closing faucet and measured in dollars, measured in gallon per cycle, for water use with electric water heating. Lifetime energy cost, based on self closing faucet and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings, based on self closing faucet and measured in dollars, for water use with electric water heating. Units to be purchased. Either Faucet or Showerhead, based on selection above. Lifetime energy and water cost savings for the number of units and item you selected, based on self closing faucet and measured in dollars, for water use with electric water heating. Your Choice with Gas Water Heating Form Labels Annual energy use, based on your choice and measured in kilowatt hour, for water use with gas water heating. Annual energy cost, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy cost, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on your choice and measured in dollars, for water use with gas water heating. Base Model with Gas Water Heating Form Labels Annual energy use, based on the base model and measured in dollars, for water use with gas water heating. Annual energy cost, based on the base model and measured in dollars, for water use with gas water heating. Lifetime energy cost, based on the base model and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on the base model and measured in dollars,, for water use with gas water heating. 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Annual energy cost, based on self closing faucet and measured in dollars, measured in gallon per cycle, for water use with gas water heating. Lifetime

energy cost, based on self closing faucet and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on self closing faucet and measured in dollars, for water use with gas water heating. Units to be purchased. Either Faucet or Showerhead, based on selection above. Lifetime energy and water cost savings for the number of units and item you selected, based on self closing faucet and measured in dollars, for water use with gas water heating. For electric water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and cost savings (per) of For gas water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and water cost savings (per) of

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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	2	*1*
Water Cost (including waste water charges)	5.4 $/1000 gal	*$4/1000 gal*
Flushes per Day	20 flushes	*30 flushes*
Days per Year	240 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	4800 gal	14400	4800	0
Annual Water Cost	$ 25	$ 77	$ 25	$ 0
10-Year Water Cost	$ 211	$ 649	$ 211	$ 0
Water Cost Savings (for replacing existing unit 10 years early)	$ 438	$ 0	$ 438	$ 649

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 $ 438 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		