LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

MORRIS COUNTY DEPARTMENT OF PUBLIC WORKS
LEWIS-MORRIS CULTURAL CENTER
300 MENDHAM RD.
MORRISTOWN, NJ 07960
ATTN: WILLIAM HUDZIK
SENIOR ENGINEERING AIDE

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:

WILLIAM CONLEY, PE
ENERGY ENGINEER
EMAIL: WCONLEY@CEG-INC.NET

REPORT ISSUANCE: **FINAL, MAY 27, 2011**

PROJECT NO: **9C10084**

TABLE OF CONTENTS

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

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

Morris County DPW
Lewis Morris Park Cultural Center
300 Mendham Rd.
Morristown, NJ 07960

Municipal Contact Person: William Hudzik
Facility Contact Person: Wallace Chang, P.E.

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 annual energy costs at this facility are as follows:

Electricity	$ 59,498
Natural Gas	$ 11,712
Total	$ 71,210

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	High Efficiency Boilers	$80,350	$1,301	61.8	-51.4%
ECM #2	Air Cooled Chiller Replacement	$42,420	$1,648	25.7	-10.6%
ECM #3	Air Handling Unit Fan Motor Replacement	$6,320	$1,415	4.5	235.8%
ECM #4	Instantaneous Hot Water Heaters	$5,805	$1,416	4.1	265.9%
ECM #5	Premium Efficiency Motors	$2,930	$214	13.7	9.6%
ECM #6	General Lighting Upgrade	$34,868	$3,190	10.9	37.2%
ECM #7	Lighting Controls	$9,445	$1,500	6.3	138.2%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	7.8 kW Solar Array	$70,380	$4,566	15.4	62.2%
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	High Efficiency Boilers	0.0	0.0	1141.0
ECM #2	Air Cooled Chiller Replacement	6.7	9809.0	0.0
ECM #3	Air Handling Unit Fan Motor Replacement	2.0	8421.0	0.0
ECM #4	Instantaneous Hot Water Heaters	5.5	11629.0	-481.0
ECM #5	Premium Efficiency Motors	0.6	1297.0	0.0
ECM #6	General Lighting Upgrade	10.9	18032.0	0.0
ECM #7	Lighting Controls	5.0	8926.0	0.0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	7.8 kW Solar Array	7.8	8815.0	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 the facility:

- **ECM #3:** Air Handling Unit Fan Motor Replacement
- **ECM #4:** Instantaneous Hot Water Heaters
- **ECM #5:** Premium Efficiency Motors
- **ECM #6:** General Lighting Upgrade
- **ECM #7:** Lighting Controls

Although **ECM #2** does not provide a payback less than 10 years, it is recommended to proceed with the installation of an efficient air cooled chiller since the current unit is past its expected lifespan. The longer a unit remains in service past its expected useful life, the risk of equipment failure increases, along with the potential for expensive maintenance and repairs. In addition, the existing air cooled chiller runs on R-22 refrigerant. This refrigerant has been phased out as of 2010 and the availability of R-22 gas will decline over the next years and all R-22 equipment will be more expensive to maintain.

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

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

Renewable Energy Measures (REMs) were also reviewed for implementation at the Lewis Morris Cultural Center. CEG utilized a roof mounted solar array to house a PV system. The recommended 7.82 kW PV system will produce approximately 8,815 kWh of electricity annually and will reduce the facility's electrical consumption from the grid by 2.5%. The system's calculated simple payback of 15.41 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, the Cultural Center appears to be operating at a high efficiency level compared to other comparable building types in the region. With the implementation of the above recommended measures the County will realize further energy savings at this facility.

II. INTRODUCTION

The comprehensive energy audit covers the 31,228 square foot Lewis Morris Park Cultural Center. This building currently houses the Morris County Park Police, the Morris County Municipal Utilities Authority (MUA), the Morris County Park Commission, the Association of New Jersey Environmental Commissions and the Morris County Heritage Commission.

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:

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. Jersey Central Power and Light (JCP&L) provides electricity to the facility under their General Service Secondary Three-Phase rate structure. A Third Part Supplier (TPS) has not been contracted. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Basic General Supply Service (GSG-HTG) rate structure. A Third Part Supplier (TPS) has not been contracted. 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.

Description	Average
Electricity	16.8¢ / kWh
Natural Gas	$1.14 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: JCP&L
Rate: General Service Secondary 3 Phase
Meter No: G28027600
Account # 10 00 07 5938 80
Third Party Utility Provider: N/A
TPS Meter / Acct No: N.A

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-10	17,760	97.3	$3,208
Feb-10	25,760	104.7	$4,156
Mar-10	25,760	68.0	$4,200
Apr-10	24,320	104.7	$3,896
May-10	26,400	100.6	$4,451
Jun-10	38,240	95.0	$6,439
Jul-10	39,040	109.4	$6,628
Aug-10	43,520	114.7	$7,339
Sep-10	32,960	100.3	$5,710
Oct-10	22,720	116.3	$4,093
Nov-10	27,680	67.0	$4,506
Dec-10	30,560	64.8	$4,872
Totals	**354,720**	**116.3 Max**	**$59,498**

AVERAGE DEMAND 95.2 KW average
AVERAGE RATE $0.168 $/kWh

Figure 1
Electricity Usage Profile

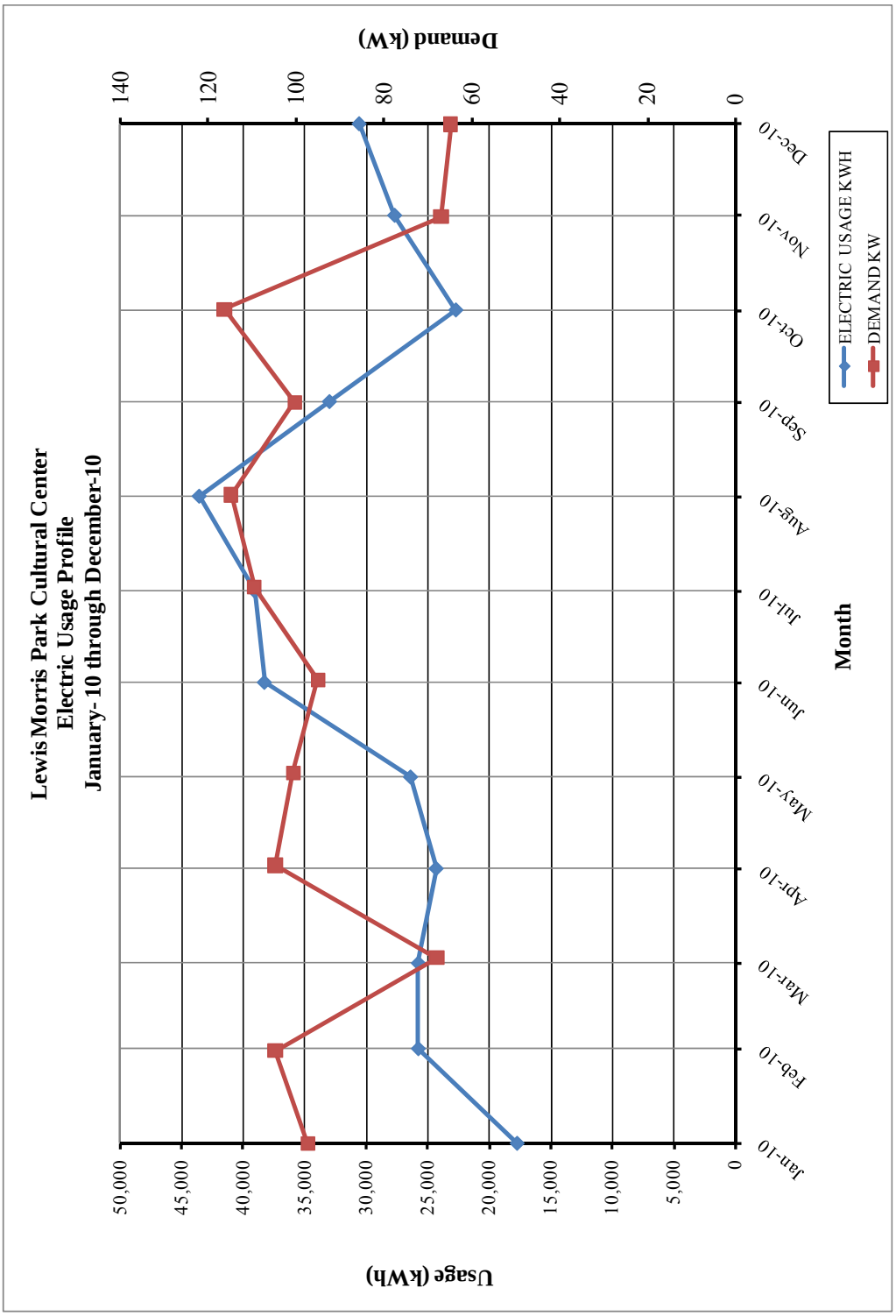
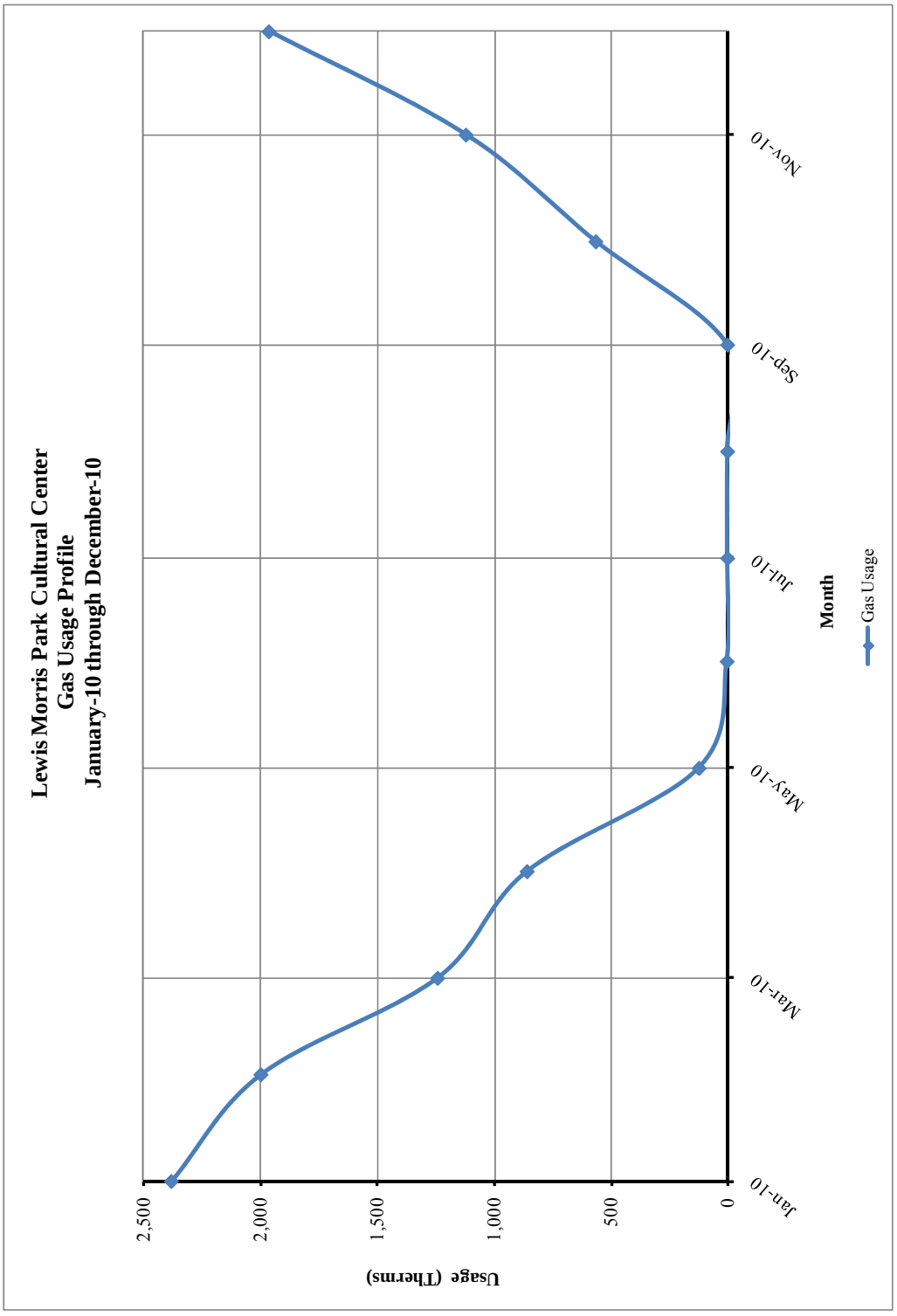


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: GSG		
Meter No: 2808423		
Point of Delivery ID: PG000011477331082242		
Third Party Utility Provider: N/A		
TPS Meter No: N/A		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-10	2,378.52	$2,921.02
Feb-10	1,996.08	$2,433.48
Mar-10	1,241.96	$1,441.69
Apr-10	859.82	$837.05
May-10	125.91	$134.57
Jun-10	6.54	$16.64
Jul-10	4.38	$15.02
Aug-10	4.38	$15.21
Sep-10	4.38	$14.81
Oct-10	566.62	$554.87
Nov-10	1,121.18	$1,162.48
Dec-10	1,962.05	$2,165.58
TOTALS	**10,271.82**	**$11,712.42**
AVERAGE RATE:	**$1.14**	**$/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:

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

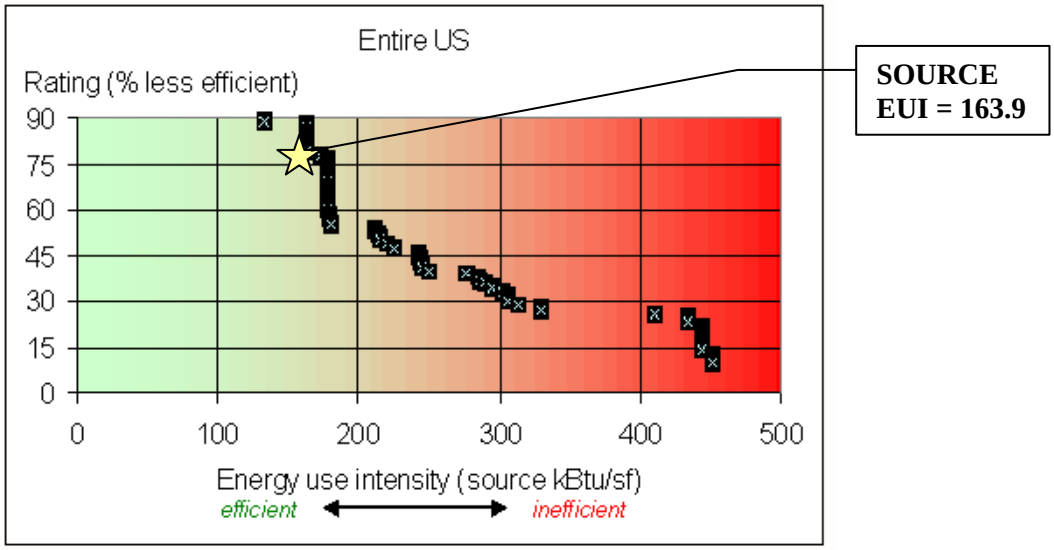
$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

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	354,720.0			1,211,014	3.340	4,044,787
NATURAL GAS		10,271.8		1,027,182	1.047	1,075,459
TOTAL				2,238,196		5,120,246
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		31,228	SQUARE FEET			
BUILDING SITE EUI		*71.67*	kBtu/SF/YR			
BUILDING SOURCE EUI		*163.96*	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.

Morris County DPW had previously created a Portfolio Manager Account for all of their facilities. CEG utilized the current information contained in the online account for the purposes of this report. 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: MorrisCounty
Password: CMORR001

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**
Lewis Morris Park Cultural Center	65	50

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

V. FACILITY DESCRIPTION

The 31,228 SF Cultural Center is a three story facility comprised of offices and storage areas for use by the Morris County Park Police, the Morris County Municipal Utilities Authority (MUA), the Morris County Park Commission, the Association of New Jersey Environmental Commissions and the Morris County Heritage Commission. Typical hours of operation of the facility are Monday through Friday 8:00 am to 5:30 pm.

The exterior walls of the building are a stucco finish with brick trim around the windows. Interior walls are a combination of drywall, plaster and exposed concrete. The amount of insulation within the wall is unknown. The windows throughout the facility are in good condition and appear to be well maintained. Typical windows throughout the facility are double pane, ¼" clear glass with wood 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 gain in the summer. The roof is a flat, built-up EPDM membrane. The amount of insulation below the roofing is unknown. The building was originally constructed in 1928. The most recent renovation was completed circa 1985, when the HVAC, lighting and plumbing were updated to accommodate the current office layout.

HVAC Systems

The second floor and third floor, which include the Parks Commission Offices, ANJEC Offices, and Morris County MUA offices, are conditioned by four (4) Trane roof mounted cooling only, constant volume air handling units with varying capacity. Cooling is provided by a 20% ethylene glycol chilled water loop. The rooftop units are the original units that were installed around 1985 and are in fair to poor condition. Several of the units were observed to have leaky chilled water control valves and leaky piping at the unit's cooling coil.

The meeting hall on the first floor is served by a Trane 15 Ton split system air conditioning unit. The indoor air handling unit is located in the basement, in the Park Police locker room and storage area. Conditioned air is distributed to the first floor via insulated ductwork and linear diffusers along the perimeter of the space. The associated condensing unit is located on the southwest end of the building, on the ground.

The main lobby of the first level is served by a 3 Ton split system unit. The indoor air handling unit is located in the basement level, in the Park Police storage room. The remote condensing unit is located outside, at grade, on the northwest side of the building. This unit is cooling only and provides conditioned air via insulated ductwork and linear ceiling diffusers. The reception room and conference area on the first level is also conditioned by a 3 Ton split system air conditioning unit. The indoor air handler is located on the basement level, above the ceiling in the Heritage Commission's storage area. This unit is cooling only and provides conditioned air via insulated ductwork and linear diffusers. The remainder of the first floor, which is the Park Police offices, is conditioned by an indoor cooling only constant volume air handling unit, AHU-5. This unit is located in the second floor mechanical room. Cooling is achieved by the chilled water loop. Conditioned air is distributed to the space via insulated ductwork and ceiling diffusers.

Heating is provided throughout the building by perimeter hot water finned tube radiation units. Hot water is generated by (4) PK Thermific N-700, 700 MBH gas fired boilers, located in the basement mechanical room. Hot water is circulated throughout the building heating loop via (2) 160 GPM, 3HP pumps, also located in the basement mechanical room.

Chilled water is provided by a Trane 60 ton air cooled chiller, located at grade on the southwest end of the building. The chiller is approximately 26 years old and is in fair condition. 20% ethylene glycol/chilled water is circulated to the air handlers on the roof and the second floor mechanical room via two (2) 127 GPM, 5 HP pumps located in the lower level mechanical room. These pumps operate in a primary/standby arrangement.

There are two split systems that serve two third floor offices of the Parks Commission. These units are Mitsubishi Mr. Slim model units and are each approximately 3 tons in cooling capacity. These units are approximately 5 years old and are in good condition. There is also a Liebert split system cooling only computer room unit that serves the second floor IT room. The exact capacity of this unit is unknown, but it was indicated during the field visit that this unit was installed at the same time the two Mr. Slim units were installed. This unit appeared to be in good condition.

Exhaust System

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

HVAC System Controls

The HVAC systems within the facility are controlled via locally mounted wall thermostats.

Domestic Hot Water

There are three small point-of-use electric hot water heaters that serve the restrooms, break rooms and janitor's closets throughout the building. The hot water heater that serves the first floor bathrooms is located in the basement, mounted above the ceiling. This unit is a 15 gallon electric A.O. Smith model ELSF-15. The other two are located on the second and third floors, respectively, and each water heater is a 10 gallon, Rheem model 81V910S electric water heater.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-12 lamps and magnetic ballasts. Some fixtures have been retrofitted with T-8 lamps, but it was indicated by facility staff that the original magnetic ballasts are still in use. Storage rooms and closets lit with a mixture of incandescent lamps and compact fluorescent lamps.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Condensing Boiler Installation

Description:

Space heating for the building is provided with perimeter baseboard radiators. The source of hot water for this equipment is a four hot water boilers located in the lower level mechanical room. These boilers are Patterson-Kelley PK Thermific N-700 models. Each boiler is rated for 700 MBH input with an output of 595 MBH. These boilers are in fair condition and are approximately 15 years old, which is within the useful life of 30 years per ASHRAE guidelines.

Typically, standard (non-condensing) boilers provide lower than nominal efficiency compared to condensing boilers. Standard boilers suffer further efficiency losses at part load operating conditions mainly due to limitations in the reduction of the flue gas temperature. The original efficiency of this model boiler, new and in excellent condition, was 85%. Current average combustion efficiency of each boiler is estimated to be 80% due to standard non-condensing boiler technology, limited turn down ratio, cycling losses, outdated design and controls, age and overall condition of the boilers. New condensing boilers could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature.

CEG recommends replacing the Paterson Kelley boilers with two(2) Aerco Benchmark BMK-1.5LN condensing boilers or equivalent. The condensing hot water boilers shall provide building with heating throughout the year. The annual average operating efficiency of the proposed boiler is expected to be 90%, which gives the heating system an approximate 10% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature.

This ECM includes installation of a two new condensing gas fired boilers to replace the four existing hot water boilers based on following summary.

BOILER REPLACEMENT SUMMARY		
EXISTING UNITs	**LOCATION**	**PROPOSED UNITS**
(4) 700 MBH Patterson-Kelley Boilers	Lower Level Mechanical Room	(2) 1500 MBH Aerco LowNOx Condensing Boilers

The owner is recommended to retain a professional engineer to confirm equipment sizing and finalize design.

Energy Savings Calculations:

Currently, the boilers are the only gas fired equipment connected to the gas meter. Therefore, annual energy consumption of the boilers is assumed to be 100% of the natural gas usage indicated in **Table 4 – Natural Gas Billing Data**. Based on this data, the existing natural gas usage of the boilers is 10,272 Therms per year

$$\text{Bldg Heat Required} = \text{Heating Nat. Gas (Therm)} \times \text{Heating Eff (\%)} \times \text{Fuel Heat Value } (\frac{\text{BTU}}{\text{Therm}})$$

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg. Heat Required (BTU)}}{\text{New Heating Eff (\%)} \times \text{Fuel Heat Value } (\frac{\text{BTU}}{\text{Therm}})}$$

$$\text{Energy Cost} = \text{Heating Gas Usage (Therms)} \times \text{Ave Fuel Cost } (\frac{\$}{\text{Therm}})$$

Energy savings calculations are summarized in the table below:

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Boilers	New Condensing Boilers	-
Existing Nat Gas (Therms)	10,272	-	-
Equivalent Building Heat Usage (MMBTUs)	822	822	-
Ave. Gas Cost ($/Therm) (Heating season only)	1.14	1.14	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	10,272	9,131	1,141
Energy Cost ($)	$11,710	$10,409	$1,301
COMMENTS:			

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Boilers	New Condensing Boilers	-
Existing Nat Gas (Therms)	10,272	-	-
Boiler Efficiency (%)	80%	90%	10%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	-
Equivalent Building Heat Usage (MMBTUs)	822	822	-
Ave. Gas Cost ($/Therm) (Heating season only)	1.14	1.14	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	10,272	9,131	1,141
Energy Cost ($)	$12,797	$11,375	$1,422
COMMENTS:			

Project Cost, Incentives and Maintenance Savings

Estimated cost for removing the existing boilers and installing (2) 1500 MBH condensing hot water boiler with advanced controls is $85,600.

From the **New Jersey Smart Start® Program Incentives Appendix**, installation of a high efficiency hot water boiler falls under the category "Gas Heating" and warrants an incentive based on efficiency at or above 84% for this type of equipment. The program incentives are calculated as follows:

GAS FIRED BOILER REBATE SUMMARY					
UNIT DESCRIPTION	**UNIT EFFICIENCY**	**REBATE $/MBH**	**PROPOSED CAPACITY, MBH**	**NUMBER OF UNITS**	**TOTAL REBATE, $**
? 300 MBH - 1500 MBH	84% AFUE for Hot Water boilers	$1.75	1,500	2	$5,250
TOTAL					**$5,250**

Maintenance savings associated with this ECM is estimated to be minimal.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$85,600
NJ Smart Start Equipment Incentive ($):	$5,250
Net Installation Cost ($):	$80,350
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,301
Total Yearly Savings ($/Yr):	$1,301
Estimated ECM Lifetime (Yr):	30
Simple Payback	61.8
Simple Lifetime ROI	-51.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$39,030
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	($54,849.83)

ECM #2: Air-Cooled Chiller Replacement

Description:

The primary source of cooling for the building is through chilled water coils in five (5) rooftop units and one (1) indoor air handling unit. Chilled water is supplied by an air cooled chiller. This chiller was installed approximately 26 years ago and has surpassed its useful service life of 23 years as outlined by ASHRAE.

The energy savings derived from replacing chillers does not typically show significant savings for this type of application. However, because of the equipment's age, it has lost efficiency due to clogged condensers, internal parts wear and deposits of oil and other contaminants on the heat exchangers. Replacing the older unit will avoids these issues along with some energy savings. In addition, new high-end chillers have significantly higher full load and part load efficiencies. Also, once equipment nears or reaches its useful service life, the chance of equipment failure increases significantly, even if the equipment has been maintained properly throughout its life.

This energy conservation measure includes replacement of the existing air cooled chiller with a new high efficiency air cooled chiller utilizing 410A refrigerant. The basis for this ECM is TRANE Model CGAM, 60 Ton air cooled chiller.

It must be noted that manufacturing of the refrigerant gas R-22 is phased out as of 2010. Although, the HVAC manufacturers continue to produce condensers and heat pumps using R22 from pre-existing R22 supplies, the availability of R22 gas will decline over the next years and R22 equipment will be more expensive to maintain.

Cooling Energy Savings Calculations:

Current Chiller Full Load Efficiency	= 9.8 EER (when new)
Proposed Efficiency	= 10.3 EEr
Current Condensing Unit Part Load Efficiency	= 13.4 IPLV* (when new)
Proposed Load Efficiency	= 15.3 IPLV

** Integrated Part Load Value*
The part load efficiency values are used in the energy savings calculation except demand savings calculations, since majority of operation hours of these units occur at part load conditions.

Annual Cooling Hours of Operation = 1470 hrs/yr (Hours above 70 °F)

$$\text{Energy Savings, kWh} = \frac{\text{Total Cooling Capacity, } \frac{\text{BTU}}{\text{RT}}}{1000\,\frac{\text{W}}{\text{kW}}} \times \left[\frac{1}{\text{IPLV}_{\text{Old}}} - \frac{1}{\text{IPLV}_{\text{New}}}\right] \times \text{Total Cooling Hours}$$

$$\text{Demand Savings, kW} = \frac{\text{Total Cooling Capacity, } \frac{\text{BTU}}{\text{RT}}}{1000\frac{\text{W}}{\text{kW}}} \times \left[\frac{1}{\text{EER}_{\text{Old}}} - \frac{1}{\text{EER}_{\text{New}}}\right]$$

$$\text{Utility Cost Savings} = \text{Total Electric Energy Savings, kWh} \times \text{Cost of Electricity}\frac{\$}{\text{kWh}}$$

Results of the energy savings calculations are summarized below:

AIR COOLED CHILLER							
EXISTING UNIT	**COOLING CAPACITY, BTU/Hr**	**ANNUAL COOLING HOURS**	**IPLV EXISTING UNIT**	**IPLV PROPOSED UNIT**	**# OF UNITS**	**ENERGY SAVINGS kWh**	**DEMAND SAVINGS kW**
ACC-1	720,000	1,470	13.4	15.3	1	9,809	6.7
Total					1	9,809	6.7

Equipment Cost and Incentives:

Estimated installed cost of a new 60-Ton air cooled chiller, controls and piping is $45,300.

From the **New Jersey Smart Start® Program Incentives Appendix**, installation of a high efficiency split condensing units falls under the category "Electric Chillers – Air Cooled" and warrants an incentive based on efficiency this type of equipment. The program incentives are calculated as follows:

AIR COOLED CHILLER REBATE SUMMARY				
UNIT DESCRIPTION	**UNIT EFFICIENCY (kW/Ton)**	**REBATE $/TON**	**PROPOSED CAPACITY TONS**	**TOTAL REBATE $**
Air Cooled Chiller	1.03	$48	60	$2,880
TOTAL			**60**	**$2,880**

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$45,300
NJ Smart Start Equipment Incentive ($):	$2,880
Net Installation Cost ($):	$42,420
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,648
Total Yearly Savings ($/Yr):	$1,648
Estimated ECM Lifetime (Yr):	23
Simple Payback	25.7
Simple Lifetime ROI	-10.6%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$37,904
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($15,320.93)

ECM #3: Air Handling Unit Fan Motor Replacement

Description:

There are a total of five (5) chilled water, cooling only air handling units. Four of these units are roof mounted and the fifth unit is located on the third floor. All of these units are approximately 26 years old and have surpassed the useful service life of 15 years, as defined by ASHRAE. The rooftop units all have 5 HP supply fans and the indoor unit has a 2 HP supply fan.

This energy conservation measure would replace the air handling unit fan motors with new NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Because many units operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

Energy Savings Calculations:

Annual Hours of Operations = 4160 (Average 80 hours/week)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.168 / kWh

AHU Motor Operating Cost =
{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency

New AHU with NEMA Premium Motor Efficiency = 86.5%

Results of the energy savings calculations are summarized below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
AHU-1	5	75%	78.0%	89.5%	0.46	1,927	$324
AHU-2	5	75%	78.0%	89.5%	0.46	1,927	$324
AHU-3	5	75%	78.0%	89.5%	0.46	1,927	$324
AHU-4	5	75%	78.0%	89.5%	0.46	1,927	$324
AHU-5	2	75%	78.0%	88.5%	0.17	712	$120
TOTAL					**2.0**	**8,421**	**$1,415**

The motor replacement schedule along with the associated costs is as follows:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
AHU-1	5	$1,318	$54	$1,264	$324	3.9
AHU-2	5	$1,318	$54	$1,264	$324	3.9
AHU-3	5	$1,318	$54	$1,264	$324	3.9
AHU-4	5	$1,318	$54	$1,264	$324	3.9
AHU-5	2	$1,318	$54	$1,264	$120	10.6
TOTAL	**Totals:**	**$6,590**	**$270**	**$6,320**	**$1,415**	**4.5**

Energy Savings Summary:

ECM #3 - PREMIUM EFFICIENCY FAN MOTORS	
Installation Cost ($):	$6,590
NJ Smart Start Equipment Incentive ($):	$270
Net Installation Cost ($):	$6,320
Electric Usage Savings, KWH	8,421
Natural Gas Usage Savings, Therms	0
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,415
Total Yearly Savings ($/Yr):	$1,415
Estimated ECM Lifetime (Yr):	25
Simple Payback	4.47
Lifetime Energy Savings	$35,370

ECM #4: Instantaneous Hot Water Heaters

Description:

The domestic hot water for the building is currently provided by three (3) small electric domestic hot water heaters. All three of these are in good condition. However, point of use, gas fired hot water heaters are more efficient and use less energy than electric point of use hot water heaters.

This energy conservation measure will replace the existing electric, 1,500 Watt, 15-gallon capacity and two (2) 2,000 Watt, 10-gallon capacity electric hot water heaters with three gas-fired, tankless water heaters. Tankless water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses associated with storage water heaters. In a gas-fired tankless water heater, a gas burner heats the water and provides a constant supply of hot water. Therefore, you do not need to wait for the storage tank to fill up with enough hot water as is typical with storage-type hot water heaters. An additional cost associated with this ECM is to provide new gas piping to the location of the existing hot water heaters. For cost estimating purposes it is assumed that natural gas piping will have to be run from the mechanical room on the main level of the facility to the new point of use hot water heaters.

Energy Savings Calculations:

$$\text{Dom.HW Heat Consumption} = \left(\frac{\text{Gal}}{\text{Min}}\right) \times 8.33 \left(\frac{\text{lb}}{\text{Gal}}\right) \times \Delta\text{T}(^{\circ}\text{F}) \times \text{Time}(\text{Min}) \times \ldots$$

$$(\#\text{People}) \times \left(\frac{\text{Use}}{\text{Day/Person}}\right) \times 365 \left(\frac{\text{Days}}{\text{Yr}}\right)$$

$$\text{Dom. HW Elec Usage} = \frac{\text{Dom HW Heat Cons.}(\text{Btu})}{\text{Heating Eff.}(\%) \times \text{Fuel Heat Value}\left(\frac{\text{BTU}}{\text{kWh}}\right)}$$

$$\text{Dom. HW Gas Usage} = \frac{\text{Dom HW Heat Cons.}(\text{Btu})}{\text{Heating Eff.}(\%) \times \text{Fuel Heat Value}\left(\frac{\text{BTU}}{\text{Therm}}\right)}$$

$$\text{Elec Energy Cost} = \text{Heating Usage}(\text{kWh}) \times \text{Ave Fuel Cost}\left(\frac{\$}{\text{kWh}}\right)$$

INSTANTANEOUS HOT WATER HEATER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Electric Hot Water Heater	Bradford White High Efficiency	
Number of People	150	150	
Lavatory Sink Time (Minutes)	0.25	0.25	
Sink Uses per Day per Person	2	2	
Faucet Gallons Per Minute (GPM)	2.5	2.5	
Domestic Water Temperature Change (°F)	70	70	
Sink Usage (BTU)	39,905,906	39,905,906	
Heating Efficiency	100%	83%	
Total Usage (BTU)	39,905,906	39,905,906	
Electric Cost ($/kWh)	0.168	0.168	
Nat Gas Cost ($/Therm)	1.14	1.14	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Consumption (kWh)	11,692	0	11,692
Nat Gas Consumption (Therms)	0	481	-481
Energy Cost ($)	$1,964	$548	$1,416
COMMENTS:	*Savings are based on LEED-NC Version 2.2 Reference Guide for faucet and shower flow rates. Usage per person is estimated.		

Cost, Rebates and Incentives

Installed cost of three (3) gas-fired 5 GPM tankless water heaters and gas piping = $5,955.

NJ Smart Start® Program Incentives are calculated as follows:

From **Appendix B**, a natural gas-fired domestic hot water heater less than 50 gallons warrants the following incentive:

$$\text{Smart Start®}\ Incentive = (Quantity \times \$50\ per\ DHW\ Heater) = (3 \times \$50) = \underline{\$150}$$

Below is the summary table for the summary of costs and incentives for this ECM.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,955
NJ Smart Start Equipment Incentive ($):	$150
Net Installation Cost ($):	$5,805
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,416
Total Yearly Savings ($/Yr):	$1,416
Estimated ECM Lifetime (Yr):	15
Simple Payback	4.1
Simple Lifetime ROI	265.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$21,240
Internal Rate of Return (IRR)	23%
Net Present Value (NPV)	$11,099.12

ECM #5: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the primary chilled water pumps in the main boiler room are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing electric motors over 5 HP or more with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
CHWP-1	Chilled Water Pump	5	2,160	83.5%	90.2%
CHWP-2	Chilled Water Pump	5	2,160	83.5%	90.2%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}}\right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWH	COST SAVINGS
CHWP-1	5	90%	83.5%	90.2%	0.30	648	$107
CHWP-2	5	90%	83.5%	90.2%	0.30	648	$107
TOTAL					**0.6**	**1,297**	**$214**

Equipment Cost and Incentives

Below is a summary of SmartStart Building® incentives for premium efficiency motors:

INCENTIVES	
HORSE POWER	NJ SMART START INCENTIVE
5	$54
7.5	$81
10	$90
15	$104
20	$113
25	$117

The following table outlines the summary of motor replacement costs and incentives:

MOTOR REPLACEMENT SUMMARY						
EQMT ID	MOTOR POWER HP	INSTALLED COST	SMART START INCENTIVE	NET COST	TOTAL SAVINGS	SIMPLE PAYBACK
CHWP-1	5	$1,519	$54	$1,465	$107	13.7
CHWP-2	5	$1,519	$54	$1,465	$107	13.7
TOTAL	**Totals:**	**$3,038**	**$108**	**$2,930**	**$214**	**13.7**

ECM #6: General Lighting Upgrade

Description: General

The lighting in the Cultural Center is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts. Some areas have fluorescent fixtures with T-8 lamps and electronic ballasts. There are a few areas of the building that utilize incandescent lighting and compact fluorescent fixtures.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix – ECM#1** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the following incentives are warranted:

Retrofit fluorescent T12 lamps and magnetic ballast with T-5 or T-8 lamps w/electronic ballast (1-4 lamp retrofitted) = $10 per fixture.

$$\text{Smart Start®}\ Incentive = \left(\#\ of\ 1-4\ lamp\ \ fixtures\ retrofitted \times\ \$10\right)$$

$$\text{Smart Start®}\ Incentive = \left(323 \times\ \$10\right) = \underline{\$3{,}230}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = \left(reduction\ in\ lamps\ replaced\ \ per\ \ year\right) \times \left(repacment\ \$\ \ per\ lamp + Labor\ \$\ \ per\ lamp\right)$$

$$Savings = \left(23\ lamps\ \ per\ \ year\right) \times \left(\$2.00 + \$5.00\right) = \$161$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$38,098
NJ Smart Start Equipment Incentive ($):	$3,230
Net Installation Cost ($):	$34,868
Maintenance Savings ($/Yr):	$161
Energy Savings ($/Yr):	$3,029
Total Yearly Savings ($/Yr):	$3,190
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.9
Simple Lifetime ROI	37.2%
Simple Lifetime Maintenance Savings	2415
Simple Lifetime Savings	$47,850
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	$3,214.01

ECM #7: Lighting Controls

Description:

Some of the lights in the building are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors and daylight sensors (The majority of the savings is expected to be after business hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for individual offices, classrooms, large bathrooms, and libraries. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = \left(\%\ \text{Savings} \times \text{Controlled Light Energy}\left(\text{kWh/Yr}\right)\right)$$

$$\text{Savings.} = \text{Energy Savings}\left(\text{kWh}\right) \times \text{Ave Elec Cost}\left(\frac{\$}{\text{kWh}}\right)$$

Cost and Incentives:

Installation cost per dual-technology sensors (Basis: Sensor switch or equivalent) are as follows:

Dual Technology Occupancy Sensor - Remote Mount	$250 per installation
Dual Technology Occupancy Sensor - Switch Mount	$150 per installation
Dual Technology Occupancy Sensor with 2 Pole Powerpack Remote mount	$300 per installation

Cost includes material and labor.

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Occupancy Sensor Wall or Switch Mounted (existing facility only) = $20 per sensor
Occupancy Sensor Remote Mounted (existing facility only) = $35 per sensor

$$\text{Smart Start® Incentive} = (\#\ \text{of wall mount} \times \$\ 20)$$
$$\text{Smart Start® Incentive} = (28\ \text{wall mount} \times \$\ 20) = \$560$$

$$\text{Smart Start® Incentive} = (\#\ \text{of remote mount} \times \$\ 35)$$
$$\text{Smart Start® Incentive} = (27\ \text{wall mount} \times \$\ 35) = \$945$$

$$\text{Total Smart Start® Incentive} = \$560 + \$945 = \$1{,}505$$

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,950
NJ Smart Start Equipment Incentive ($):	$1,505
Net Installation Cost ($):	$9,445
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,500
Total Yearly Savings ($/Yr):	$1,500
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.3
Simple Lifetime ROI	138.2%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$22,500
Internal Rate of Return (IRR)	14%
Net Present Value (NPV)	$8,461.90

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 Generation

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

CEG has reviewed 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 550 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 7.82 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 8,815 KWh annually, reducing the overall utility bill by approximately 2.5% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

The array system capacity was sized on available roof 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 County paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

Table 7
Financial Summary – Photovoltaic System

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	15.4 Years	6.5%	4.8%

*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 County to invest in a solar system through a Direct Purchase CEG does not recommend the County pursue this route. It would be more

advantageous for the County 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 County 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, it was determined that the average wind speed of <4.5 m/s is not adequate for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

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 electricity usage profile demonstrates a load profile that has all of usage occurring during On Peak (8am-10pm – Monday thru Friday) usage. Historical usage fluctuates throughout the year and is higher during the summer months. Historical average monthly usage is 29.560 kWh and the average monthly demand is 95kW. Largest consumption months were June, July, August, September and December.

The historical usage profile is satisfactory and may provide competitive energy supply pricing when shopping for Third Party Energy Suppliers. Third Party Energy Supplier (TPS) electric commodity contracts that offer's a firm, fixed price for 100% of the facilities electric requirements and are lower than the JCP&L's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months have little consumption. The average winter (Nov-Mar) consumption is 1,740 therms and the average summer (Apr-Oct) consumption is 225 therms. The largest consumption month is January at 2,379 therms.

This load profile will yield less favorable natural gas pricing when shopping for alternative suppliers. This is because the higher winter month consumption will yield higher pricing which will not be offset by the summer month consumption. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October. Obtaining a flat load profile, (usage is similar each month), will yield optimum natural gas pricing when shopping for alternative suppliers. Third Party Supplier (TPS) natural gas commodity contracts that offer product structures that include either 1) a firm, fixed price or 2) market based rate with basis lock in for 100% of the facility's natural gas requirements are recommended due to current low market pricing.

Tariff Analysis:

Electricity:

This facility receives electrical service through Jersey Central Power & Light (JCP&L) on a GS-Sec (General Service Secondary) rate. Service classification GS-Sec is available for general service purposes on secondary voltages not included under Service Classifications RS, RT, RGT or GST. This facility's rate is a single or three phase service at secondary voltages. This facility has not contracted a Third Party Supplier (TPS) to provide electric commodity service. For electric supply (generation) service, the client has a choice to either use JCP&L's default service rate BGS-FP or contract with a Third Party Supplier (TPS) to supply electric.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February.

BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. This service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP).

The facility's current BGS-FP average price to compare for GS-Sec rate is $0.1269/kWh.

The utility, JCP&L will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from.

JCP&L's Delivery Service rate includes the following charges: Customer Charge, Supplemental Customer Charge, Distribution Charge (kW Demand), kWh Charge, Non-utility Generation Charge, TEFA, SBC, SCC, Standby Fee and RGGI.

Natural Gas:

This facility currently receives natural gas distribution service through Public Service Electric and Gas (PSE&G) on rate schedule GSG (General Service Gas) and has not contracted a Third Party Supplier (TPS) to provide natural gas commodity service.

PSE&G provides basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier

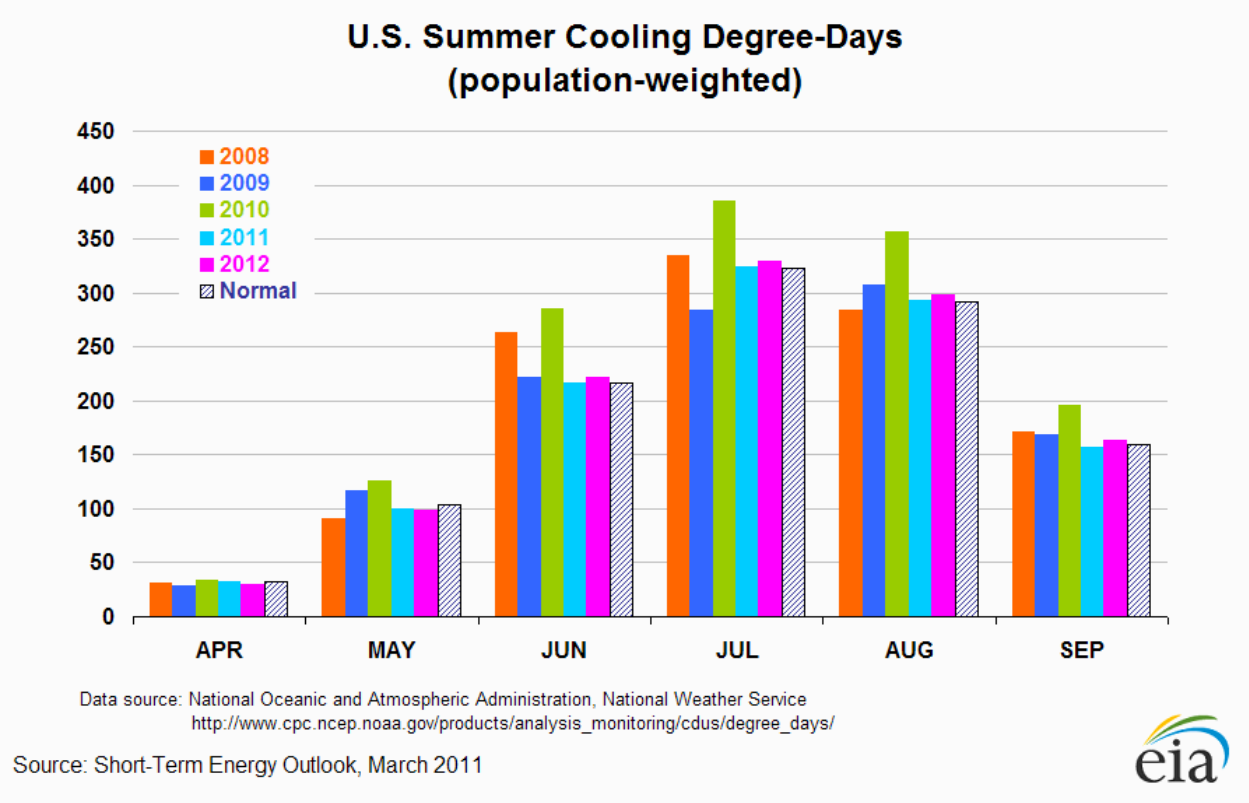
defaults or fails to provide commodity service. Please refer to the link below for a recap of monthly natural gas BGSS charges from PSE&G for rate schedule GSG.
http://pseg.com/family/pseandg/tariffs/gas/pdf/commodity.pdf

The utility, PSE&G is responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSE&G's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2010, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts are dependable only in the short-term, prolonged temperature extremes can really cause extreme price swings.



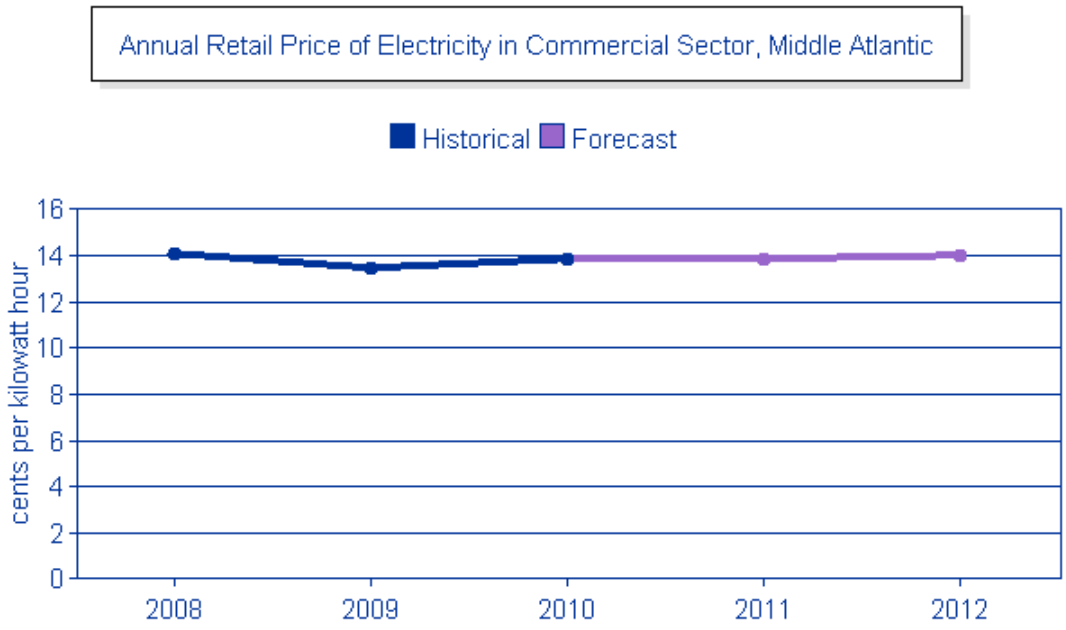
Short Term Energy Outlook - US Energy Information Administration (3/08/2011):

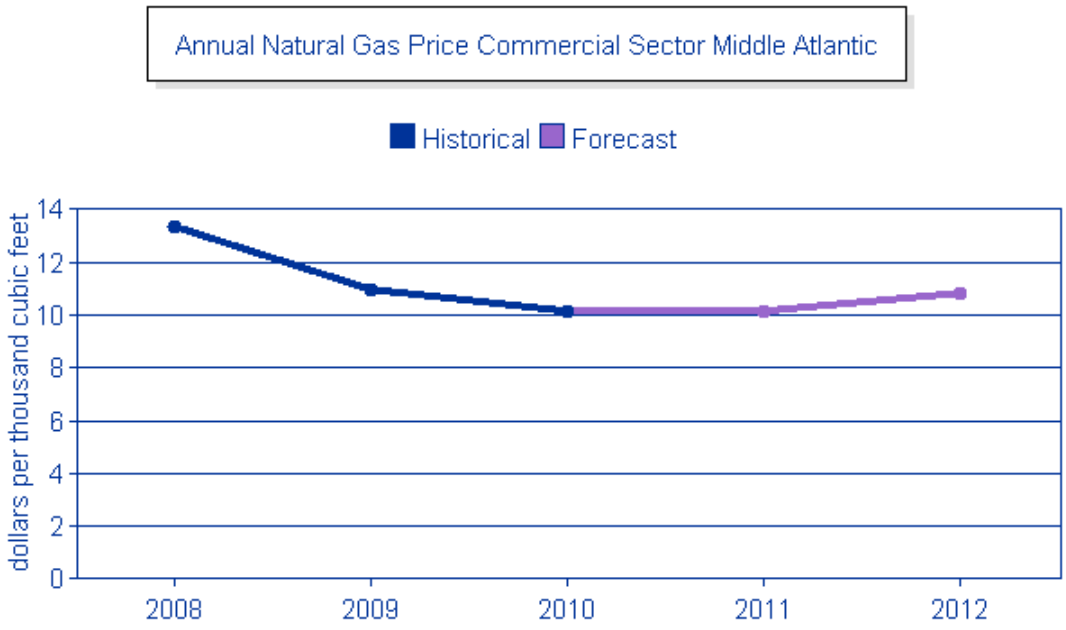
U.S. Natural Gas Prices. *The Henry Hub spot price averaged $4.09 per MMBtu in February 2011, $0.40 per MMBtu less than the average spot price in January 2011. EIA expects that the Henry Hub spot price will average $4.10 per MMBtu in 2011, a drop of $0.29 per MMBtu from the 2010 average. EIA expects the natural gas market to begin to tighten in 2012, with the Henry Hub spot price increasing to an average of $4.58 per MMBtu.*

Uncertainty over future natural gas prices is slightly lower this year compared with last year at this time. Natural gas futures for May 2011 delivery (for the 5-day period ending March 3) averaged $3.98 per MMBtu, and the average implied volatility over the same period was 33 percent. This produced lower and upper bounds for the 95-percent confidence interval for May 2011 contracts of $3.09 per MMBtu and $5.11 per MMBtu, respectively. At this time last year, the natural gas May 2010 futures contract averaged $4.77 per MMBtu and implied volatility averaged 39 percent. The corresponding lower and upper limits of the 95-percent confidence interval were $3.57 per MMBtu and $6.39 per MMBtu.

U.S. Electricity Retail Prices. *During 2010, retail prices for electricity distributed to the residential sector averaged 11.58 cents per kilowatthour, about the same level as in 2009. EIA expects residential prices to rise by 1.0 percent in 2011, followed by an increase of 0.5 percent in 2012. The effect of lower generation fuel costs in 2011 should be more evident in retail prices*

for electricity distributed to the industrial sector, which EIA projects will fall 1.6 percent during 2011 and then rise 0.2 percent next year.





Pricing in the chart above includes both utility distribution and energy commodity charges.

Recommendations:

1. CEG recommends an aggregated approach for 3rd party commodity supply procurement strategies for electric and natural gas supply service. Aggregating all County facilities for electricity and natural gas supply service would allow this facility to achieve a reduction in both electric and natural gas supply costs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. This facility could realize up to a 20% reduction in energy supply costs, if it were to aggregate usage with the other County facilities and take advantage of these current market prices quickly, before energy increases.

   Overall, after review of the utility consumption, billing, and current commodity pricing outlook, CEG recommends that the County explore the utilization and advisement of a 3rd party unbiased Energy Consulting Firm experienced in the procurement of electricity and natural gas, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. In addition, the firm should be able to provide full service advisement over the term of the contract to identify additional opportunities to further reduce costs. Many of these opportunities may include: energy rates; utility bill auditing; energy data analytics; and efficiency improvements.

   It is important that a rational, defensible strategy for purchasing commodity in volatile markets is incorporated. Examples include:

   - Budgets that reflect sound market intelligence
   - An understanding of BGS historical prices and trends
   - Awareness of seasonal opportunities (e.g. shoulder months)
   - Negotiation of fair contractual terms
   - An aggressive, market based price

2. CEG recommends that the County consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, natural gas and electric for incorrect billings and rate tariff optimization services. This service can be based on a shared savings model with no cost to the County. The service could provide refunds on potential incorrect billings that may have been passed through by the utilities and paid by the County.

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 100 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 60% 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.

vi. *Energy Efficiency and Conservation Block Grants* – The EECGB rebate provides supplemental funding up to $20,000 for counties and local government entities to implement energy conservation measures. The EECGB funding is provided through the American Recovery and Reinvestment Act (ARRA). The local

government must be among the eligible local government entities listed on the NJ Clean Energy website as follows - http://njcleanenergy.com/commercial-industrial/programs/eecbg-eligible-entities. This program is limited to municipalities and counties that have not already received grants directly through the US department of Energy.

This incentive is provided in addition to the other NJ Clean Energy program funding. This program's incentive is considered the entity's capital and therefore can be applied to the LGEA program's requirements to implement the recommended energy conservation measures totaling at least 25% of the energy audit cost. Additional requirements of this program are as follows:

1. The entity must utilize additional funding through one or more of the NJ Clean Energy programs such as Smart Start, Direct Install, and Pay for Performance.

2. The EECBG funding in combination with other NJ Clean Energy programs may not exceed the total cost of the energy conservation measures being implemented.

3. Envelope measures are applicable only if recommended by the LGEA energy audit and if the energy audit was completed within the past 12 months.

4. New construction and previously installed measures are not eligible for the EECBG rebate.

5. Energy conservation measures eligible for the EECBG must fall within the list of approved energy conservation measures. The complete list of eligible measures and other program requirements are included in the "EECBG Complete Application Package." The application package is available on the NJ Clean Energy website - http://njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants.

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.

XII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

A. Cost Estimates noted within this report are based on industry accepted costing data such as RS Means™ Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
    a. operating hours
    b. equipment type
    c. control strategies
    d. scheduling
D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.

Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Cultural Center

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 #1	High Efficiency Boilers	$59,000	$26,600	$5,250	$80,350	$1,301	$0	$1,301	30	$39,030	$0	-51.4%	61.8	-4.14%	($54,849.83)
ECM #2	Air Cooled Chiller Replacement	$30,900	$14,400	$2,880	$42,420	$1,648	$0	$1,648	23	$37,904	$0	-10.6%	25.7	-0.92%	($15,320.93)
ECM #3	Air Handling Unit Fan Motor Replacement	$6,590	$0	$270	$6,320	$1,415	$0	$1,415	15	$21,225	$0	235.8%	4.5	21.13%	$10,572.18
ECM #4	Instantaneous Hot Water Heaters	$2,382	$3,573	$150	$5,805	$1,416	$0	$1,416	15	$21,240	$0	265.9%	4.1	23.34%	$11,099.12
ECM #5	Premium Efficiency Motors	$3,038	$0	$108	$2,930	$214	$0	$214	15	$3,210	$0	9.6%	13.7	1.16%	($375.28)
ECM #6	General Lighting Upgrade	$15,239	$22,859	$3,230	$34,868	$3,029	$161	$3,190	15	$47,850	$2,415	37.2%	10.9	4.24%	$3,214.01
ECM #7	Lighting Controls	$4,380	$6,570	$1,505	$9,445	$1,500	$0	$1,500	15	$22,500	$0	138.2%	6.3	13.51%	$8,461.90
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	7.8 kW Solar Array	$70,380	$0	$0	$70,380	$1,481	$3,085	$4,566	25	$114,150	$77,125	62.2%	15.4	4.13%	$9,128.43

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

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	$25 per fixture (1-2 lamps) $30 per fixture (3-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	$7 per bulb
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

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

Other Equipment Incentives

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
LEWIS MORRIS PARK CULTURAL CENTR

Building ID: 2383877
For 12-month Period Ending: November 30, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 21, 2011

Facility
LEWIS MORRIS PARK CULTURAL CENTR
MENDHAM ROAD
MORRIS TOWNSHIP, NJ 07963

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1928
Gross Floor Area (ft²): 31,228

Energy Performance Rating[2] (1-100) 65

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,385,358
Natural Gas (kBtu)[4]	938,117
Total Energy (kBtu)	2,323,475

Energy Intensity[5]

Site (kBtu/ft²/yr)	74
Source (kBtu/ft²/yr)	180

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	246

Electric Distribution Utility
Jersey Central Power & Light Co [FirstEnergy Corp]

National Average Comparison

National Average Site EUI	88
National Average Source EUI	213
% Difference from National Average Source EUI	-16%
Building Type	Office

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. 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.

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Rooftop / Indoor AC Units

Tag	RTU-1	RTU-2	RTU-3
Unit Type	Cooling only air handling unit	Cooling only air handling unit	Cooling only air handling unit
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	3rd Floor Parks Commission Offices	3rd Floor Parks Commission Offices	3rd Floor Parks Commission Offices
Manufacturer	Trane	Trane	Trane
Model #	CPL-2991-2585	CPL-2991-2585	CPL-2991-2585
Serial #	K85L80997	K85L80998	K85L80999
Cooling Type	Chilled Water/Glycol	Chilled Water/Glycol	Chilled Water/Glycol
Cooling Capacity (MBH)	147.6	106.0	147.6
Supply Fan CFM	4500	3500	4500
Supply Fan HP	5	5	5
Fan Efficiency	Standard	Standard	Standard
Volts / Phase / Hz	208 / 3 / 60	208 / 3 / 60	208 / 3 / 60
Approx Age	26	26	26
ASHRAE Service Life	15	15	15
Remaining Life	(11)	(11)	(11)
Comments			

Rooftop / Indoor AC Units

Tag	RTU-4	AC-5	AC-6
Unit Type	Cooling only air handling unit	Cooling only air handling unit	Cooling Only AHU
Qty	1	1	1
Location	Roof	2nd Floor Mech Closet	Basement
Area Served	2nd Floor Parks Commission Offices	2nd Floor ANJEC and Parks Commission Offices	Basement Storage Area
Manufacturer	Trane	Trane	Lennox
Model #	CPL-2991-2585	-	B10-65-1P
Serial #	K85L81000	K85L81C4C	5481J04850
Cooling Type	Chilled Water/Glycol	Chilled Water/Glycol	D/X
Cooling Capacity (MBH)	106.0	92.0	-
Supply Fan CFM	3500	3000	-
Supply Fan HP	5	2	-
Fan Efficiency	Standard	Standard	-
Volts / Phase / Hz	208 / 3 / 60	208 / 3 / 60	
Approx Age	26	26	
ASHRAE Service Life	15	15	15
Remaining Life	(11)	(11)	
Comments			

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Split AC Units - Indoor Air Handling Units

Tag	AHU-1	AHU-2	AHU-3
Unit Type	Split AC unit	Split AC unit	Split AC unit
Qty	1	1	1
Location	Basement Ceiling	Basment, Police Storage Room Ceiling	Basment Men's Rm Clg
Area Served	Lobby	Archive Room	Unknown
Manufacturer	Trane	Carrier	Trane
Model #	2TEC3F360B	40AQ04300B6	-
Serial #	6404PKT2V	X3A10139	64226KD2V
Cooling Type	D/X	D/X	D/X
Cooling Capacity (MBH)	36	36	24
Supply Flow, CFM	2,000	1,200	-
Heating Type	N/A	N/A	N/A
Heating Capacity (MBH)	N/A	N/A	N/A
Supply Motor HP	1/2	-	-
Supply Motor Efficiency	Standard	Standard	-
Volts / Phase	208/1	208/1	208/1
Approx. Age	5	28	5
ASHRAE Service Life	15	15	15
Comments	Unit is in good condition	Unit is in fair to poor condition	Unit is in fair condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Split AC Units - Outdoor Condensing Units

Tag	CU-1	CU-2	CU-3
Qty	1	1	1
Unit Served	AHU-1	AHU-2	AHU-3
Location	Outside, NW side of building	Outside, NW side of building	Outside, NW side of building
Manufacturer	Trane	Trane	Trane
Model #	2TTB3036A	2TTB30360A1000D	2TTR2024A
Serial #	6343LMY3F	6425U711F	4095KBA34
Cooling Capacity (Btuh)	36,000	36,000	24,000
Cooling Eff., SEER	13	13	12
Refrigerant	R-22	R-22	R-22
Volts / Phase	208/1	208/1	208/1
Approx Age	5	5	7
ASHRAE Service Life	15	15	15
Remaining Life	10	10	8
Comments	Unit is in good condition	Unit is in good condition	Unit is in fair condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Split AC Units - Indoor Air Handling Units

Tag	AHU-4	AC-7	AC-8
Unit Type	Split AC unit	Split AC unit	Split AC unit
Qty	1	1	1
Location	Basment, Police Area	3rd Floor Offices	3rd Floor Offices
Area Served	1st Floor Meeting Room	3rd Floor Offices	3rd Floor Offices
Manufacturer	Trane	Mitsubishi	Mitsubishi
Model #	TWE180B300EL	PKA-A36KA	PKA-A36KA
Serial #	6441PACHD	-	-
Cooling Type	D/X	D/X	D/X
Cooling Capacity (MBH)	180	34.2	34.2
Supply Flow, CFM	6,000	780-990	780-990
Heating Type	N/A	N/A	N/A
Heating Capacity (MBH)	N/A	N/A	N/A
Supply Motor HP	3	-	-
Supply Motor Efficiency	Standard	-	-
Volts / Phase	208/3	208-230/1	208-230/1
Approx. Age	5	5	5
ASHRAE Service Life	15	15	15
Comments	Unit is in good condition	Unit is in good condition	Unit is in good condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Split AC Units - Outdoor Condensing Units

Tag	CU-4	CU-7	CU-8
Qty	1	1	1
Unit Served	AHU-4	AC-7	AC-8
Location	Outside, SW side of building	Roof	Roof
Manufacturer	Trane	Mitsubishi	Mitsubishi
Model #	TTA180B300FA	PUY-A36NHA3	PUY-A36NHA3
Serial #	64333EUAD	-	-
Cooling Capacity (MBH)	180	12-34.2	12-34.2
Cooling Eff., EER	9.7	13.1	13.1
Refrigerant	R-22	R-410A	R-410A
Volts / Phase	208/3	208-230/1	208-230/1
Approx Age	5	5	5
ASHRAE Service Life	15	15	15
Remaining Life	10	10	10
Comments	Unit is in good condition	Unit is in good condition	Unit is in good condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Boilers

Tag	Boiler-1 thr 4		
Unit Type	Gas Fired Hot Water, Non-condensing		
Qty	4		
Location	Basment MER		
Area Served	Building Heating Loop		
Manufacturer	Patterson Kelley		
Model #	PK Thermific N-700		
Serial #	N/A		
Input Capacity (MBH)	700		
Rated Output Capacity (MBH)	595		
Approx. Efficiency %	80%		
Fuel	Natural Gas		
Approx Age	15		
ASHRAE Service Life	30		
Remaining Life	15		
Comments	Boilers are in fair condition		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Chiller

Tag	CH-1		
Unit Type	Air cooled		
Qty	1		
Location	At grade, on Southwest end of building		
Area Served	AHU's-1 thru 5		
Manufacturer	Trane		
Model #	CGABC606AE003		
Serial #	J85J82499		
Refrigerant	R-22		
Cooling Capacity (Tons)	60		
Cooling Efficiency (EER)	9.8		
IPLV	13.4		
Volts / Phase / Hz	208 / 3 / 60		
Fuel	N/A		
Chilled Water GPM / ΔT	127 GPM / 10°F		
Condenser Fan Qty.	6		
Condenser Fan HP (Ea)	1.5		
Approx Age	26		
ASHRAE Service Life	23		
Remaining Life	(3)		
Comments	Chiller is in fair condition		

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Domestic Water Heaters

Tag	HWH-1	HWH-2	HWH-3
Unit Type	Point of Use	Point of Use	Point of Use
Qty	1	1	1
Location	Baement	2nd floor janitor's closet	3rd floor janitor's closet
Area Served	1st floor restrooms	2nd floor restrooms	3rd floor restrooms
Manufacturer	A.O. Smith	Rheem	Rheem
Model #	ELSF-15	81VP10S	81VP10S
Serial #	-	0508604712	1105617134
Size (Gallons)	15	10	10
Input Capacity (MBH/KW)	1.5	2	2
Recovery (Gal/Hr)	-	-	-
Efficiency %	N/A	N/A	N/A
Fuel	Electricity	Electricity	Electricity
Approx Age	5	3	6
ASHRAE Service Life	12	12	12
Remaining Life	7	9	6
Comments	Heater is in good condition	Heater is in good condition	Heater is in good condition

MAJOR EQUIPMENT LIST

Concord Engineering Group

Lewis Morris Cultural Center

Pumps

Tag	CHWP-1 & 2	HWP-1 & 2
Unit Type	In-line	In-Line
Qty	2	2
Location	Basement MER	Basement MER
Area Served	Chilled Water Loop	Heating Hot Water Loop
Manufacturer	Bell & Gossett	Armstrong
Model #	Series 80	4380
Serial #	-	-
Horse Power	5	2
Flow	127 GPM @ 56FT HD	160 GPM @ 35FT HD
Motor Info	Unimount, Model UT-1-TE	Model JN182J
Electrical Power	208V/3Ph	208V/3Ph
RPM	1750	1750
Motor Efficiency %	Standard	Standard
Approx Age	26	26
ASHRAE Service Life	20	20
Remaining Life	(6)	(6)
Comments	Pumps are in poor condition	Pumps are in poor condition

CEG Job #: 9C10084
Project: Morris County DPW
Address: 300 Mendham Rd
Morristown, NJ 07961
Building SF: 31,228

Cultural Center

KWH COST $0.168

ECM #7: 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
142.21	Basement Quesioning	365	2	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.312	113.88	$19.13	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	156	0.25	20%	91.104	$15.31	$250.00	$250.00	0.06	22.776	$3.83	65.34
126.1	Basement Archives	365	6	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Parabolic Lens	78	0.468	170.82	$28.70	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.37	20%	136.656	$22.96	$250.00	$250.00	0.09	34.164	$5.74	43.56
111.14	Basement Storage	365	28	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Pendent Mnt., No Lens	48	1.344	490.56	$82.41	28	1	Dual Technology Occupancy Sensor - Remote Mnt.	48	1.08	20%	392.448	$65.93	$250.00	$250.00	0.27	98.112	$16.48	15.17
126.1	Basement Entrance	365	1	2	2-Lamp, T12, Magnetic Ballast, Surface Mounted, Parabolic Lens	78	0.078	28.47	$4.78	1	0	No Change	78	0.08	0%	28.47	$4.78	$0.00	$0.00	0.00	0	$0.00	0.00
3	Basement Electrical Room	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	0	No Change	60	0.06	0%	21.9	$3.68	$0.00	$0.00	0.00	0	$0.00	0.00
111.14	Basement Vault	730	40	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Pendent Mnt., No Lens	48	1.92	1401.6	$235.47	40	1	Dual Technology Occupancy Sensor - Remote Mnt.	48	1.54	20%	1121.28	$188.38	$250.00	$250.00	0.38	280.32	$47.09	5.31
3	Basement Phone	365	3	1	Surface Mnt, 60w A19 Lamp	60	0.18	65.7	$11.04	3	0	No Change	60	0.18	0%	65.7	$11.04	$0.00	$0.00	0.00	0	$0.00	0.00
3	Basement Elevator Machine Room	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	0	No Change	60	0.06	0%	21.9	$3.68	$0.00	$0.00	0.00	0	$0.00	0.00
560	Basement Stairs	2080	1	1	Recessed Down Light, 26w CFL Lamp	26	0.026	54.08	$9.09	1	0	No Change	26	0.03	0%	54.08	$9.09	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Basement Corridor 001	2080	7	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.434	902.72	$151.66	7	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.35	20%	722.176	$121.33	$250.00	$250.00	0.09	180.544	$30.33	8.24
142.21	Basement Detective Bureau	2080	26	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	4.056	8436.48	$1,417.33	26	1	Dual Technology Occupancy Sensor - Remote Mnt.	156	3.24	20%	6749.184	$1,133.86	$250.00	$250.00	0.81	1687.296	$283.47	0.88
127.21		2080	6	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.252	524.16	$88.06	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	42	0.20	20%	419.328	$70.45	$250.00	$250.00	0.05	104.832	$17.61	14.20
560		2080	1	1	Recessed Down Light, 26w CFL Lamp	26	0.026	54.08	$9.09	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	26	0.02	20%	43.264	$7.27	$250.00	$250.00	0.01	10.816	$1.82	137.58
221.11		2080	1	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.062	128.96	$21.67	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.05	20%	103.168	$17.33	$250.00	$250.00	0.01	25.792	$4.33	57.70
111.14	Basement Boiler Room	365	2	1	1x4, 1-Lamp, 34w T12, Mag. Ballast, Pendent Mnt., No Lens	48	0.096	35.04	$5.89	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	48	0.08	20%	28.032	$4.71	$250.00	$250.00	0.02	7.008	$1.18	212.34
127.21	First Floor Lobby	1040	17	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.714	742.56	$124.75	17	0	No Change	42	0.71	0%	742.56	$124.75	$0.00	$0.00	0.00	0	$0.00	0.00
3		1040	9	1	Surface Mnt, 60w A19 Lamp	60	0.54	561.6	$94.35	9	0	No Change	60	0.54	0%	561.6	$94.35	$0.00	$0.00	0.00	0	$0.00	0.00
127.21		2080	8	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.336	698.88	$117.41	8	0	No Change	42	0.34	0%	698.88	$117.41	$0.00	$0.00	0.00	0	$0.00	0.00

ECM #7: 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
126.44	First Floor 105	2080	2	2	4"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	78	0.156	324.48	$54.51	2	0	No Change	78	0.16	0%	324.48	$54.51	$0.00	$0.00	0.00	0	$0.00	0.00
221.11		2080	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	257.92	$43.33	2	0	No Change	62	0.12	0%	257.92	$43.33	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	First Floor Stairs	4380	1	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.062	271.56	$45.62	1	0	No Change	62	0.06	0%	271.56	$45.62	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	First Floor Kitchen 103	1040	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	193.44	$32.50	3	1	Dual Technology Occupancy Sensor - Remote Mnt.	62	0.15	20%	154.752	$26.00	$250.00	$250.00	0.04	38.688	$6.50	38.46
127.21	First Floor Meeting Hall 102	1040	23	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.966	1004.64	$168.78	23	1	Dual Technology Occupancy Sensor - Remote Mnt.	42	0.77	20%	803.712	$135.02	$250.00	$250.00	0.19	200.928	$33.76	7.41
621		1040	21	1	Wall Sconce, (1) 40w A19 Lamp	40	0.84	873.6	$146.76	21	1	Dual Technology Occupancy Sensor - Remote Mnt.	40	0.67	20%	698.88	$117.41	$250.00	$250.00	0.17	174.72	$29.35	8.52
221.11	First Floor Storage Room	365	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	67.89	$11.41	3	0	No Change	62	0.19	0%	67.89	$11.41	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	Second Floor Break Room 217	1040	4	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.624	648.96	$109.03	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	156	0.50	20%	519.168	$87.22	$250.00	$250.00	0.12	129.792	$21.81	11.47
127.21	Second Floor Closet	365	1	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.042	15.33	$2.58	1	0	No Change	42	0.04	0%	15.33	$2.58	$0.00	$0.00	0.00	0	$0.00	0.00
127.21	Second Floor Office 222	2080	4	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.168	349.44	$58.71	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.13	20%	279.552	$46.96	$150.00	$150.00	0.03	69.888	$11.74	12.78
142.21	Second Floor Office 224	2080	4	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.624	1297.92	$218.05	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	156	0.50	20%	1038.336	$174.44	$150.00	$150.00	0.12	259.584	$43.61	3.44
142.21	Second Floor Office 22	2080	4	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.624	1297.92	$218.05	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	156	0.50	20%	1038.336	$174.44	$150.00	$150.00	0.12	259.584	$43.61	3.44
242.31	Second Floor Office 216	2080	4	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.428	890.24	$149.56	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.34	20%	712.192	$119.65	$150.00	$150.00	0.09	178.048	$29.91	5.01
3	Second Floor Closet	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	0	No Change	60	0.06	0%	21.9	$3.68	$0.00	$0.00	0.00	0	$0.00	0.00
142.21	Second Floor Office 225	2080	3	4	2x4, 4 Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	156	0.468	973.44	$163.54	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	156	0.37	20%	778.752	$130.83	$150.00	$150.00	0.09	194.688	$32.71	4.59
242.31	Second Floor Office 227	2080	6	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.642	1335.36	$224.34	6	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.51	20%	1068.288	$179.47	$150.00	$150.00	0.13	267.072	$44.87	3.34
242.31	Second Floor Office	2080	3	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.321	667.68	$112.17	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.26	20%	534.144	$89.74	$150.00	$150.00	0.06	133.536	$22.43	6.69
127.21	Second Floor Office 213	2080	4	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.168	349.44	$58.71	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.13	20%	279.552	$46.96	$150.00	$150.00	0.03	69.888	$11.74	12.78
242.31	Second Floor Office	2080	2	4	2x4, 4 Lamp, 32w 700 Series T8, Elect. Ballast, Pendant Mnt., Prismatic	107	0.214	445.12	$74.78	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	107	0.17	20%	356.096	$59.82	$150.00	$150.00	0.04	89.024	$14.96	10.03

ECM #7: 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
122.21	Second Floor Stairs	4380	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.156	683.28	$114.79	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.12	20%	546.624	$91.83	$250.00	$250.00	0.03	136.656	$22.96	10.89
3	Second Floor Break Room Closet	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	60	0.05	20%	17.52	$2.94	$250.00	$250.00	0.01	4.38	$0.74	339.75
3	Second Floor Break Room Closet #2	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	1	Dual Technology Occupancy Sensor - Remote Mnt.	60	0.05	20%	17.52	$2.94	$250.00	$250.00	0.01	4.38	$0.74	339.75
127.21	Second Floor Break Room	1040	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	87.36	$14.68	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	69.888	$11.74	$150.00	$150.00	0.02	17.472	$2.94	51.10
227.11	Second Floor Men's Room	2080	3	2	2x2, 2 Lamp, 32w 700 series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.195	405.6	$68.14	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.16	20%	324.48	$54.51	$150.00	$150.00	0.04	81.12	$13.63	11.01
221.11		2080	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	257.92	$43.33	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	206.336	$34.66	$150.00	$150.00	0.02	51.584	$8.67	17.31
227.11	Second Floor Women's Room	2080	4	2	2x2, 2 Lamp, 32w 700 series T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	65	0.26	540.8	$90.85	4	1	Dual Technology Occupancy Sensor - Switch Mnt.	65	0.21	20%	432.64	$72.68	$150.00	$150.00	0.05	108.16	$18.17	8.25
221.11		2080	2	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.124	257.92	$43.33	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.10	20%	206.336	$34.66	$150.00	$150.00	0.02	51.584	$8.67	17.31
127.21	Second Floor Corridor	4380	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	367.92	$61.81	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	294.336	$49.45	$150.00	$150.00	0.02	73.584	$12.36	12.13
126.44	Second Floor Office	2080	1	2	4"x4, 2 Lamp, 34w T12, Mag. Ballast, Wall Mnt., White Diffuser	78	0.078	162.24	$27.26	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.06	20%	129.792	$21.81	$150.00	$150.00	0.02	32.448	$5.45	27.52
142.22	Second Floor Office	2080	1	4	4x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.156	324.48	$54.51	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	156	0.12	20%	259.584	$43.61	$150.00	$150.00	0.03	64.896	$10.90	13.76
142.22	Second Floor Office	2080	1	4	4x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.156	324.48	$54.51	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	156	0.12	20%	259.584	$43.61	$150.00	$150.00	0.03	64.896	$10.90	13.76
142.22	Second Floor Library	2080	2	4	4x4, 4 Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	156	0.312	648.96	$109.03	2	1	Dual Technology Occupancy Sensor - Remote Mnt.	156	0.25	20%	519.168	$87.22	$250.00	$250.00	0.06	129.792	$21.81	11.47
3	Third Floor Mech Room	365	1	1	Surface Mnt, 60w A19 Lamp	60	0.06	21.9	$3.68	1	1	Dual Technology Occupancy Sensor - Switch Mnt.	60	0.05	20%	17.52	$2.94	$150.00	$150.00	0.01	4.38	$0.74	203.85
122.21	Third Floor Corridor	4380	14	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	1.092	4782.96	$803.54	14	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.87	20%	3826.368	$642.83	$150.00	$150.00	0.22	956.592	$160.71	0.93
122.21	Third Floor Exec. Director	2080	8	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.624	1297.92	$218.05	8	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.50	20%	1038.336	$174.44	$150.00	$150.00	0.12	259.584	$43.61	3.44
122.21	Third Floor Secretary	2080	5	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.39	811.2	$136.28	5	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.31	20%	648.96	$109.03	$250.00	$250.00	0.08	162.24	$27.26	9.17
122.21	Third Floor Office	2080	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.468	973.44	$163.54	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.37	20%	778.752	$130.83	$250.00	$250.00	0.09	194.688	$32.71	7.64
127.21	Third Floor Emerg. EX. Corridor	4380	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	367.92	$61.81	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	294.336	$49.45	$150.00	$150.00	0.02	73.584	$12.36	12.13

ECM #7: 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
127.21	Third Floor Men's Room	2080	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	174.72	$29.35	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	139.776	$23.48	$150.00	$150.00	0.02	34.944	$5.87	25.55
127.21		2080	3	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.126	262.08	$44.03	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.10	20%	209.664	$35.22	$150.00	$150.00	0.03	52.416	$8.81	17.03
127.21	Third Floor Women's Room	2080	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	174.72	$29.35	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	139.776	$23.48	$150.00	$150.00	0.02	34.944	$5.87	25.55
221.11		2080	3	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.186	386.88	$65.00	3	1	Dual Technology Occupancy Sensor - Switch Mnt.	62	0.15	20%	309.504	$52.00	$150.00	$150.00	0.04	77.376	$13.00	11.54
127.21	Third Floor Kitchen/Break Room	1040	2	2	2x2, 2 Lamp, 40w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	42	0.084	87.36	$14.68	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	42	0.07	20%	69.888	$11.74	$150.00	$150.00	0.02	17.472	$2.94	51.10
122.21		1040	2	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.156	162.24	$27.26	2	1	Dual Technology Occupancy Sensor - Switch Mnt.	78	0.12	20%	129.792	$21.81	$150.00	$150.00	0.03	32.448	$5.45	27.52
122.21	Third Floor Recep.	2080	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.468	973.44	$163.54	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.37	20%	778.752	$130.83	$250.00	$250.00	0.09	194.688	$32.71	7.64
122.21	Third Floor Transfer Sta.. Acct.	2080	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.468	973.44	$163.54	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.37	20%	778.752	$130.83	$250.00	$250.00	0.09	194.688	$32.71	7.64
122.21	Third Floor Conference Room	1040	6	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.468	486.72	$81.77	6	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.37	20%	389.376	$65.42	$250.00	$250.00	0.09	97.344	$16.35	15.29
122.21	Third Floor Treasurer	2080	8	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.624	1297.92	$218.05	8	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.50	20%	1038.336	$174.44	$250.00	$250.00	0.12	259.584	$43.61	5.73
122.21	Third Floor Human Resource	2080	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.312	648.96	$109.03	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.25	20%	519.168	$87.22	$250.00	$250.00	0.06	129.792	$21.81	11.47
122.21	Third Floor Library	1040	4	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	0.312	324.48	$54.51	4	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	0.25	20%	259.584	$43.61	$250.00	$250.00	0.06	64.896	$10.90	22.93
122.21	Third Floor Main Office Area	2080	23	2	2x4, 2-Lamp, 34w T12, Mag. Ballast, Recessed Mnt., Prismatic Lens	78	1.794	3731.52	$626.90	23	1	Dual Technology Occupancy Sensor - Remote Mnt.	78	1.44	20%	2985.216	$501.52	$250.00	$250.00	0.36	746.304	$125.38	1.99
121.11	Third Floor Stairs 2-3	4380	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.078	341.64	$57.40	1	0	No Change	78	0.08	0%	341.64	$57.40	$0.00	$0.00	0.00	0	$0.00	0.00
121.11	Third Floor Stairs 1-2	4380	4	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.312	1366.56	$229.58	4	0	No Change	78	0.31	0%	1366.56	$229.58	$0.00	$0.00	0.00	0	$0.00	0.00
221.11	Third Floor Fire Esc. Stairs B-3	4380	6	2	1x4, 2 Lamp, 32w 700 Series T8, Elect. Ballast, Surface Mnt., Prismatic Lens	62	0.372	1629.36	$273.73	6	0	No Change	62	0.37	0%	1629.36	$273.73	$0.00	$0.00	0.00	0	$0.00	0.00
1	Fourth Floor Corridor	4380	1	1	22w Circuline Fluor.	25	0.025	109.5	$18.40	1	0	No Change	25	0.03	0%	109.5	$18.40	$0.00	$0.00	0.00	0	$0.00	0.00
121.11		4380	1	2	1x4, 2-Lamp, 34w T12, Mag. Ballast, Surface Mnt., Prismatic Lens	78	0.078	341.64	$57.40	1	0	No Change	78	0.08	0%	341.64	$57.40	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		399	103			28.5	51,573.0	$8,664	399	55			23.5		42,646.9	$7,164.68		$10,950	5.00	8,926	$1,500	7.30

Project Name: LGEA Solar PV Project - Lewis Morris Cultural Center
Location: Morristown, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$70,380
Annual kWh Production	8,815
Annual Energy Cost Reduction	$1,481
Annual SREC Revenue	$3,085
First Cost Premium	**$70,380**
Simple Payback:	**15.41** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.168**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$70,380	0	0	0	$0	(70,380)	0
1	$0	8,815	$1,481	$0	$3,085	$4,566	($65,814)
2	$0	8,771	$1,525	$0	$3,070	$4,595	($61,219)
3	$0	8,727	$1,571	$0	$3,054	$4,626	($56,593)
4	$0	8,683	$1,618	$0	$3,039	$4,657	($51,936)
5	$0	8,640	$1,667	$89	$3,024	$4,602	($47,334)
6	$0	8,597	$1,717	$89	$3,009	$4,637	($42,697)
7	$0	8,554	$1,768	$88	$2,994	$4,674	($38,023)
8	$0	8,511	$1,821	$88	$2,979	$4,713	($33,310)
9	$0	8,469	$1,876	$87	$2,964	$4,753	($28,557)
10	$0	8,426	$1,932	$87	$2,949	$4,795	($23,763)
11	$0	8,384	$1,990	$86	$2,934	$4,838	($18,924)
12	$0	8,342	$2,050	$86	$2,920	$4,884	($14,041)
13	$0	8,300	$2,111	$85	$2,905	$4,931	($9,110)
14	$0	8,259	$2,175	$85	$2,891	$4,980	($4,129)
15	$0	8,218	$2,240	$85	$2,876	$5,032	$902
16	$0	8,177	$2,307	$84	$2,862	$5,085	$5,987
17	$0	8,136	$2,376	$84	$2,847	$5,140	$11,127
18	$0	8,095	$2,448	$83	$2,833	$5,198	$16,325
19	$0	8,054	$2,521	$83	$2,819	$5,257	$21,582
20	$0	8,014	$2,597	$83	$2,805	$5,319	$26,901
21	$1	7,974	$2,675	$82	$2,791	$5,384	$32,285
22	$2	7,934	$2,755	$82	$2,777	$5,450	$37,735
23	$3	7,895	$2,838	$81	$2,763	$5,519	$43,254
24	$4	7,855	$2,923	$81	$2,749	$5,591	$48,846
25	$5	7,816	$3,010	$81	$2,736	$5,665	$54,511
	Totals:	207,646	$53,993	$1,778	$72,676	$124,891	($195,993)
				Net Present Value (NPV)		**$54,536**	
				Internal Rate of Return (IRR)		**4.8%**	

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
Cultural Center	550	Sunpower SPR230	34	14.7	500	7.82	8,815	1,122	15.64

N
W E
S

.= Proposed PV Layout

PVWatts AC Energy & Cost Savings

Cautions for Interpreting the Results

Lewis Morris Cultural Center

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	7.8 kW
DC to AC Derate Factor:	0.810
AC Rating:	6.3 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	135.0°
Energy Specifications	
Cost of Electricity:	16.8 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.24	434	72.91
2	3.04	543	91.22
3	3.96	776	130.37
4	4.76	871	146.33
5	5.66	1037	174.22
6	5.93	1025	172.20
7	5.71	1008	169.34
8	5.52	950	159.24
9	4.54	793	133.22
10	3.48	641	107.69
11	2.26	406	68.21
12	1.90	352	59.14
Year	4.07	8815	1480.92

Notes:

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